

THE GOLOID DOLLAR.

STATEMENTS

BEFORE THE

COMMITTEE ON COINAGE, WEIGHTS, AND MEASURES

UPON THE

Subject of coinage and the goloid dollar.

FEBRUARY 5, 1878.—Recommitted to the Committee on Coinage, Weights, and Measures, and ordered to be printed.

WASHINGTON, D. C., January 17, 1878.

STATEMENT OF DR. H. R. LINDERMAN, DIRECTOR OF THE MINT.

Mr. VANCE. I would like to have your views on the "goloid" question.

Dr. LINDERMAN. Mr. Chairman, in 1873, when the threatened change or alteration in the relative values of the precious metals first attracted the attention of the country, and which was in consequence of the demonetization of silver by the German Empire, a somewhat similar proposition to the one now before the committee was presented to me in a communication from L. A. Garnett, of San Francisco.

The color of that coin so alloyed would differ in no respect from that of the silver coins of nine-tenths or eleven-twelfths fineness. That was one and the principal objection. The other was derived from the fact that it differed from all coins and standards of value adopted among the civilized nations of the world.

On account of these two objections the project was abandoned at that time. The same person subsequently, in a verbal communication, contended that we should have our gold combined with other metals, so as to keep it from being melted down.

I held then that it would detract from its value, first as money, and second as bullion, and that it should be in a shape to be convertible readily into one or the other. This present proposition has passed under my consideration, and I have had a coin produced of standard silver, with the same impressions as the goloid dollar, in order to show you the uniformity in color of the two coins.

I will take one of these (exhibiting the two coins) goloid dollars, and will place it with another of standard silver of the same weight and struck on the same die. I shall have to look myself to see which one is the goloid dollar. One of these is goloid and one is not. It is very

difficult for anybody to tell the difference, for the general appearance is the same. The difference between one and the other is not perceptible. One is worth about 60 cents and the other is worth a dollar.

Mr. VANCE. How can you distinguish the one from the other?

Dr. LINDERMAN. I have it marked.

Mr. VANCE. Could you not distinguish it without the mark?

Dr. LINDERMAN. I could not. I have looked very carefully and it would deceive me. This (the silver coin) is made of standard silver nine-tenths fine. This is the goloid. The distinction between them is in the one being blurred in one of the characters, the letter "O."

The proposition seemed a very ingenious one. The purpose to be accomplished by it was the union of the two metals in the same coin in such proportions that, when combined, the silver would bear to the gold the ratio of about sixteen to one, so that they could not be separated, and make it a legal tender in payment of all debts and duties. It was very ingenious. I think the ready manner in which it can be imitated, leaving out all the gold or part of it, is a fatal objection. That is my candid opinion about it.

On the question of its commercial value it has two aspects. One is that you cannot use this alloy for melting down for manufacturing plate and jewelry. Before these goloid coins could be converted into plate or into the coins of countries having other standards, the metals would have to be separated by what is termed parting, and which would tend rather to depreciate the value of the alloy. On the other hand, the goloid metal corresponds in some degree with the greater portions of the gold and silver produced going under the name of doré silver.

This class of bullion is produced from the mines of the Comstock and those of Mexico. That class of bullion has generally commanded in London something more than fine silver for refining purposes, being of a proportion to allow other grades of bullion to be added and the entire mass more cheaply refined or parted than if each mass were refined separately. This might compensate for the mere objection made to goloid from the difficulties attending the separation of the silver from the gold. That there is no alteration as to color, that nine grains of gold make no alteration that is perceptible to the eye, and that there would be no means of testing it or machine by which it could be tested, would be a very serious objection.

I have thought it due to the committee to procure the views of the officers of the mint at Philadelphia. I have them here in writing and will leave the same with the committee, to be returned to me.

I will, however, read the communication of the assayer, which considers the respective advantages of and objections to the introduction of goloid. He confines himself to the technical points.

The CHAIRMAN. The communications may be placed in the hands of the reporter, to be incorporated in the report.

Dr. LINDERMAN. These two coins (exhibiting them) are struck from the same die; one is the goloid dollar, the other of standard silver.

Mr. VANCE. These two coins, the goloid and the silver dollar, are they of the same weight?

Dr. LINDERMAN. I have just received them from the mint. I do not know whether they are or not.

Mr. VANCE. What would be the weight of this coin in standard silver?

Dr. LINDERMAN. It would make it exactly 258 grains.

Mr. VANCE. You think a countryman would be as apt to take one as the other?

Dr. LINDERMANN. I think he would.

(The coins being weighed on metric scales, it was informally announced that the silver was the heavier by one and a half gram.)

Dr. LINDERMANN. The coiner was ordered to have it struck as near as possible of the same weight and size as the other.

The assayer writes as follows:

MINT OF THE UNITED STATES AT PHILADELPHIA,
Assay Department, January 16, 1878.

SIR: In accordance with the order from the Director, the alloy called "goloid" has been thoroughly tested here, both before and after coinage. I have the following statement to make as to its properties:

First, let me say that it does not come within my province to speak of certain points which are claimed as advantages, such: 1. That this mixture of gold and silver would destroy the rivalry between the two metals, and compel them both to be used as currency. 2. The size of the dollar would be much reduced, as compared with the silver dollar. 3. It would not be melted down, to be used in manufactures. There is obviously much force in these points, and of course they will receive due consideration.

I now take up the matter technically.

1. Although a ternary compound—gold, silver, and copper—it mixes as well in melting as the standard binary alloy of gold and silver. We are constantly getting these triple alloys. Only yesterday I reported a deposit which contained those three metals, in nearly the same proportions.

2. The goloid is as ductile as standard silver, and would work as well in mintage.

3. Its specific gravity is a little above that of standard silver, being 10.28 in the ingot, and 10.50 after striking in a screw-press, which is the highest compression. Standard silver in the ingot shows 10.24, and when struck as above, 10.33. The difference is due to the gold present, and would afford a test of genuineness in the hands of an experienced operator with first-class balance.

4. Its color is precisely that of standard silver; so would it be if the gold were ten times as much. It is only as we reach nearly equal proportions that the yellowish tint appears.

5. Its sonority or ring is really the same as that of standard silver. The sound is more prolonged. But this very delicate test would be of no use to ordinary examiners.

6. It is acted upon by the usual acid solvents precisely as standard silver is; the goloid, of course, bearing a residuum of gold in powder. Neither mixture is touched by muriatic or hydrochloric acid, cold or hot.

7. Nothing can be said in advance about the wear or abrasion. There is no reason to expect any difference.

8. The danger of imitations, leaving the gold entirely out, would, of course, be very great. Assuming well-made false dies, there would be no test at all in the hands of ordinary dealers. Our own short test by acid-mixture entirely fails. Nothing would do but trying the specific gravity, which is slow work, and apt to be incorrectly done.

These are all the points which come within my range as an assayer. Judged by those propensities, the goloid coin has no advantages. On the contrary, it would be held by scientific men everywhere as a retrograde movement. The study has been all along to get gold and silver as completely separated as possible. They are hardly in a merchantable shape while intermixed. For that reason they would be parted as soon as exported, and they would be worthless by so much as the cost of parting—say 1½ cents per dollar.

I do not agree with this exactly, for adding a higher grade of partable gold would overcome this. I do not regard this as an objection. The real objection I regard as the similarity in color.

Within the mint the danger of getting the two metals, whether ingots or clippings, mixed up would require incessant watch. If it is adopted, standard silver, even for dimes, had better be banished.

Dr. LINDERMANN. If adopted for one class of coins it should be adopted for all coins. The assayer also suggests it ought not to be called "goloid," and that the term is a misnomer as it is not like it in appearance and the gold does not predominate.

He further says:

In conclusion, I beg to correct an error which is stamped on the goloid specimen coin—that of calling it nine-tenths (.9 fine). Standard gold is nine-tenths fine, and so is

standard silver; but where the two are put together the term loses its meaning. It is like making an addition of six oranges and three apples; they cannot be made into one sum.

Very respectfully,

WM. E. DUBOIS,
Assayer.

Hon. JAMES POLLOCK,
Superintendent, &c.

(Specimen attached.)

I inclose a slip of goloid on which a gum-elastic band was laid for one day.

Dr. LINDERMAN. I cannot leave this coin (the imitation). I must send it back to the mint and have it defaced.

Dr. HUBBELL. It has not the ring of the other.

Dr. LINDERMAN. After all that is said and done, the great test is color among the people.

Dr. HUBBELL. They have made the silver coin the heavier in order to show that the goloid is not of greater density, and they have made it thicker.

Dr. LINDERMAN. It is struck on the same die, so as to give it the same appearance. The ease with which they could counterfeit the goloid would render their introduction very dangerous. This coin made from standard silver would weigh 258 grains, which would be worth about sixty cents, leaving a profit of forty cents on these imitations of the goloid dollar. This profit would induce a large amount of counterfeiting.

Dr. HUBBELL. How many of these could be coined with the present force of the mint?

Dr. LINDERMAN. If we adopted or established this coinage no others would be made. We would have no occasion for two standards.

Dr. HUBBELL. The gold coins could be five, ten, and twenty dollars.

Dr. LINDERMAN. If these coins were adopted we would have a combined representative of the unit of value. We would have two classes of coins if the goloid alloy be adopted. It might perhaps do, or be necessary, to have double-eagles.

Dr. HUBBELL. How many of these goloid dollars, with the present force of the mint, could you coin per month?

Dr. LINDERMAN. From six to eight millions.

Dr. HUBBELL. How much could you coin of the old silver dollar?

Dr. LINDERMAN. About half as much, about three millions of dollars.

Dr. HUBBELL. You could coin double the quantity of goloid coin with the same mint capacity?

Dr. LINDERMAN. I think so; I speak of all three mints.

Dr. HUBBELL. Do you think it would be worth while for counterfeiters to use capital in purchasing silver to make these coins to secure a profit of forty cents? Do they usually invest so much to make so small a profit?

Dr. LINDERMAN. Some four or five years ago there was a machine invented, known as the drop process for making dies, and with which the inventors claimed to make a better die from our coin than the mint dies on which the latter were struck. I wanted to have them prosecuted for making these coins from dies made in that way. They went over the other side of the water. I had a letter from the master of the London mint recently, and they had tried to sell their right, and reported that it had been bought by four different governments in Europe. They asked \$20,000 for it. They then wanted to sell it to the British.

It has been a subject of correspondence between myself and the master of the London mint. How long it would take to put a manufacturing establishment in operation for producing coin in this way we do not know. They could make the dies with but little cost. They did the work very ingeniously, and they could easily counterfeit the coin.

Dr. HUBBELL. Do not they counterfeit the present coin?

Dr. LINDERMAN. No, sir; not with success. There is a sense of sight and touch as to gold and silver coins that is perceptible to almost every one.

Dr. HUBBELL. Is there not a difference between these two coins?

Dr. LINDERMAN. I have not been able to distinguish it.

Dr. HUBBELL. This, the silver, coin oxydizes and the goloid does not.

Dr. LINDERMAN. You have not had it long enough to say whether it does or not.

Dr. HUBBELL. Do not they also counterfeit the gold coin so that you cannot tell the difference between them by the color?

Dr. LINDERMAN. I think not.

Dr. HUBBELL. Do not they make counterfeits by putting less gold in?

Dr. LINDERMAN. They may counterfeit by making false dies, but they must have a good margin. They would have a good margin if they were to leave the gold out of this coin. Forty cents would be a good margin on a dollar.

Dr. HUBBELL. Could not part of the gold be taken from the gold dollar without greatly changing the appearance?

Dr. LINDERMAN. If anything like that proportion were taken from it almost everybody could detect it; if eight grains, which is near a third of a gold dollar, were taken from it, it would be very perceptible. There is but very little counterfeiting of gold done. I have not seen a piece in ten years. I have seen some pieces that had been drilled into and some of the gold taken from them and the space filled up with platinum.

Dr. HUBBELL. Suppose they left a dollar's worth of gold out of the eagle, and made the counterfeit by adding some other metal, would that be readily detected?

Dr. LINDERMAN. The color would show it.

Dr. HUBBELL. Do you think they could distinguish by the difference in color the counterfeit in such a case from the genuine eagle?

Dr. LINDERMAN. I think so; the nearest approach in color of any known composition is aluminum and copper. The weight is different.

Dr. HUBBELL. In your report from the mint the weight of the goloid differs from that of standard silver?

Dr. LINDERMAN. I have said nothing about the weight of goloid in my report. I do not remember which the reports of the officers of the mint states is the heavier.

Dr. HUBBELL. Is it not a fact that a piece of goloid would be heavier than a piece of standard silver of the same size and thickness?

Dr. LINDERMAN. I do not know what difference there would be in the weight, but if it were one and one-half grains, that would still furnish but very little protection against the counterfeit coin. If you take one grain of gold from the alloy there is four cents gone, which would be a pretty serious loss on a dollar, and the difference in weight would be very slight. We should have to use extreme care to determine the genuineness of coin.

Dr. HUBBELL. Did you ever try the test of light? It will throw a yellow reflection on the wall if the light be thrown upon it, while the reflection cast by the silver will be white.

Dr. LINDERMAN. I cannot see the difference. I cannot see how the

difference in the reflection on the wall would be sufficient to furnish a practical test. I think we can conclude this branch of the subject by saying that so far as we are advised there is no getting over this similarity of color. The color is substantially the same with that of standard silver of nine-tenths or eleven-twelfths fineness, and this fine test of light is too delicate for use among the people.

Dr. HUBBELL. Is not that a counterfeit of the goloid dollar?

Dr. LINDERMAN. The impression is the same. The difference, as I before said, between the two coins is that in the silver coin the "O" is imperfect.

(It is suggested by the committee that this discussion be terminated, and that Dr. Linderman be requested to proceed with his statement relative to the other questions concerning which the committee have requested information.)

The CHAIRMAN. Doctor, I will ask you a question or two. How much silver could be coined within twelve months with all the machinery of the mints?

Dr. LINDERMAN. We have three coinage mints. One at Philadelphia, one at San Francisco, and one at Carson. The latter is quite small as compared with the two first.

We coined last year, with our full capacity, silver coins to the value of twenty-nine millions, amounting in number, perhaps, to eighty millions of pieces. At the same time we struck some forty millions of gold and some token coins, &c.

First, the San Francisco mint, I estimate the silver-coinage capacity at \$1,500,000, the Philadelphia mint at \$1,500,000, and the Carson mint at about \$500,000, per month, giving as a maximum capacity \$3,500,000 per month. We can only work our skilled hands so many hours. In addition to the one million five hundred thousand per month at the Philadelphia and San Francisco mints, we should have to make our gold coins, besides some fractional silver and token coins; but when the machinery is run on extra time, as it is sometimes done, I should say we could turn out thirty-six millions of silver dollars in twelve months, and that that was the utmost capacity of the mints.

The CHAIRMAN. What additional machinery would be required, and what would it cost, to turn out a hundred millions of silver dollars?

Dr. LINDERMAN. The capacity of the two mints on the Pacific coast can be increased but little; that at Philadelphia cannot be increased any. I do not know that any of them could be increased but by the addition of new machinery. Some increase could be made at the mint at San Francisco. Even that would give but little addition to our present coin capacity as to the present mints.

The next point would be to re-establish coinage at New Orleans. We have a large mint there. The building is said to be in good condition, except that the wall of the building is sunk a little on one side, which could be easily remedied.

An appropriation of from seventy-five to one hundred thousand dollars would enable us to put that mint in order. That would cover everything. I should say the capacity of the New Orleans mint would be nearly equal to the capacity of the Philadelphia mint; that is, for the coinage of silver dollars. The main coinage there would be silver dollars.

I mention the New Orleans mint without desiring to intimate that the mint should be established there, and simply because we have a suitable building there. It would encounter the Mexican silver. When the mint was there we had considerable trade in foreign silver. We used to ship

in the year 1853 a million of ounces at a time in the form of ingots to the Philadelphia mint from the New Orleans mint.

Without knowing exactly the capacity of that mint, we could in reasonable time bring its coinage up to about fifteen hundred thousand silver dollars a month, about the same as that of the Philadelphia mint.

Mr. VANCE. How is it in regard to the mint at Charlotte?

Dr. LINDERMAN. There was a mint there for the coinage of gold before the war; Charlotte, N. C. There is a very good building.

Mr. VANCE. What machinery is there there?

Dr. LINDERMAN. I believe there is none left. The machinery was taken away and stored at Philadelphia, that it might be preserved. It is not suitable for silver coinage.

Mr. VANCE. Do you recollect the maximum coinage of gold there?

Dr. LINDERMAN. I was there in 1869. I think it ran from two to four hundred thousand dollars a year. I could tell exactly by looking at my reports; about the same amount was coined at Dahlonega.

The CHAIRMAN. The government has granted it to an agricultural college, which has three hundred students.

Mr. BREWER. What would be the probable expense of erecting a building for a mint, and putting in machinery, having the capacity of the Philadelphia mint, for the coinage of silver dollars?

Dr. LINDERMAN. That would depend a good deal on who built it.

Mr. VANCE. And on where it was built?

Dr. LINDERMAN. Yes, sir. If it were attempted to bring stone from Massachusetts and carry them to Mississippi, it would cost a good deal. We built the little assay office at Helena, Mont., at a less cost than fifty thousand dollars, and, I think, one of the same size at Boisé, in Idaho, in 1871 or 1872; I can hardly recollect the exact date. I think where all the facilities exist for getting stone for the foundation, and facilities for the making of good bricks, a good building could be put up for one hundred and fifty thousand dollars—built mainly of brick—a good, substantial building. The machinery would cost about one hundred thousand more.

Mr. BREWER. About two hundred and fifty thousand dollars?

Dr. LINDERMAN. From that to three hundred thousand dollars. I am not in favor of these expensive buildings. I believe the San Francisco mint cost nearly two millions of dollars.

I do not see why a mint should be over two stories high, of brick. As far as burglars are concerned, we rely on vaults and shot-guns in the hands of good men—of watchmen. There is very little danger of attacks upon the mints. There has never been any attack made upon the mints. The people look upon the mints as something to be respected. The employés of the mints, except in a very few instances, have never been guilty of wrong-doing. They seem to get character and encouragement to act rightly from the employés they find there, and show no disposition to peculation.

I would wish to make a few remarks upon another question for the benefit of the committee.

There has been introduced by Mr. Cox, of New York, a bill providing for the coinage of five-cent silver pieces. I desire to repeat what I stated to him in a letter covering the bill, when he asked me to prepare it. The only difficulty, and the substantial difficulty, is that in 1865 or in 1866 (the date is immaterial, however), Congress passed an act authorizing the coinage of five-cent nickel coins, and made them redeemable in national currency. These words "national currency," I take it, mean legal-tender notes; and when such notes become redeemable in gold the

nickel coins would be superior to the proposed five-cent silver coins. The fractional silver coins not being redeemable in national currency, the former would therefore be the superior coin for money purposes, and would be expelled from the circulation and be driven to the Treasury by the five-cent silver pieces. There would be a continual demand for the legal-tender notes in exchange for these nickel coins.

The effect of the free issue of five-cent silver coins would be to bring some five millions of dollars in nickel coins to be redeemed in legal-tenders. That is the objection I urge to the bill.

The five-cent nickel coins, if redeemed, melted down, and sold as metal, would not bring one-fifth of that sum.

The CHAIRMAN. Are not these coins needed to be kept in the circulation to make change?

Dr. LINDERMAN. In the first place, the people do not like to have these small silver coins; besides, it would not be well to have two coins of the same denomination in circulation, one inferior to the other.

Mr. CLARK. There are but a small number of the five-cent silver coins?

Dr. LINDERMAN. That is true, but if you were to see the accumulated mass of these three-cent postal-currency pieces which come to the Treasury you would be surprised. The Treasurer told me he had taken in three thousand dollars in these coins in one day, and that he wanted an appropriation in order to have them melted down. In connection with this matter, I desire to call the attention of the committee to another matter of importance. The government receives the difference between the bullion value and the nominal value of the fractional silver coinage, and by the time we get through the amount authorized to be issued this would amount to some four or five millions of dollars; and inasmuch as this result had been reached by reason of the legal-tender quality given the issue, imparted to it by the government, and the benefits which the government has derived therefrom, it is eminently proper that the government should assume the expense of keeping them in good condition from the effects of wear and tear. I think a law should be passed, that while the government takes the seigniorage they should also be required to take care of these coins, and have all coins, halves, quarters, and dimes recoined when so unduly reduced in weight by natural wear as to render them unfit for use, and upon the depositing of these abraded coins in the mints to be recoined when, say, the percentage of loss from natural causes is about four per cent., receive them and issue new coins in their stead. I think the recognized rate of wear in the German Empire is four per cent. as to subsidiary coin.

If the committee would like it, I will send a section of law which will cover this question for its consideration.

The CHAIRMAN. I do not doubt but that the committee will be pleased to consider it.

Dr. LINDERMAN. I regard this as an important matter. While we are engaged in considering the question of a new standard, this should be disposed of. Of course, in providing for the renovation of coin, it would seem to be entirely wrong to charge the holders with the inevitable loss from the wear and tear of that coinage, so long as the government enjoys the seigniorage. They get nothing excepting the weight. It is furnished by the government. It must become worn. In about fifteen years you will begin to see some of these pieces defaced and worn, and not in proper condition for circulation. It might then be difficult to get suitable legislation, when the amount required to renovate the worn coins would be considerable and require special appropriations;

whereas they could be kept in a good condition at an annual expense of a few thousand dollars.

Mr. RYAN. There is no foreign coin here, I take it, except occasional pieces?

Dr. LINDERMAN. No, sir.

Mr. RYAN. Can you form an opinion as to the probable amount of silver that could be coined per annum under the provisions of the Bland silver bill with unlimited mint coinage?

Dr. LINDERMAN. I stated the maximum would be thirty-six millions.

The CHAIRMAN (to Mr. Ryan). You were not here at the time Dr. Linderman had previously made this statement?

Mr. RYAN. I assume the capacity for coinage to be unlimited, with a capacity to coin all that shall come in under the Bland bill. What, in your judgment would be the amount coming to the mints for coinage?

Dr. LINDERMAN. Well, that covers a pretty wide field for discussion. If what I understand by your question is correct, there is, I would say in reply, a small amount always in our vaults. What amount could be regularly controlled under present circumstances and the unsettled condition of silver—nobody can tell what the amount would be which would come to us from abroad. The countries using the ratio fifteen and a half to one must adhere to it, for that is the ratio in which their contracts were made and debts created, and in which they are payable. I should say, at a round guess, that there is from seven hundred and fifty thousand to one thousand millions of legal tender silver coin, as expressed in our money, in circulation in the countries using that ratio, and to change this would inevitably lead to great financial disturbance. I do not mean a change from gold to silver or from silver to gold as the standard, but to make any change which would affect the legal tender of the existing five-franc silver-pieces, the only silver coin representing silver in the ratio stated.

I come to the next proposition, the supply from the different silver-producing countries. The Mexican production would be about twenty-five millions—probably twenty-three millions—of silver. A part of this goes to San Francisco and the greater part to London. A part of the production of Mexico will of course be held in that country for money purposes.

I think that if the Bland bill, as passed by the House, was to become a law and the New Orleans mints were opened for coinage, a large amount would come to that mint from Mexico for coinage.

The coining rate or mint value of silver under the Bland bill would be fifty-nine pence per ounce British standard, or \$1.16⁴/₁ per ounce nine-hundredths fine, our standard.

The price of silver at present is about fifty-four pence. While this difference, or anything like it, shall continue, we would be apt to receive all Mexico could spare—say fifteen millions of dollars per annum. We would be likely to get three millions from South American countries, which would come here in the ordinary course of trade. Then, for the first two years, we would get at least twenty five millions a year from Europe. We could not make estimates which would be likely to hold good for a longer period than two years.

This estimate gives only my general opinion and nothing else. When carefully weighing all the circumstances which would probably be connected with the movement of silver, I think that is about as much as we could rely upon. The German supply might be about thirty-five millions for two years.

The CHAIRMAN. You think that thirty-five millions would be the total supply coming from Germany in two years.

Dr. LINDERMAN. Thirty-five millions each year. This, of course, is only an approximate estimate, and circumstances may materially alter it.

Mr. MULDROW. What caused the demonetization of silver in Germany?

Dr. LINDERMAN. It is a good deal like people living in communities. You will see that England, which is a commercial country, in 1816 adopted gold as the sole standard, and, by reason of being a commercial and a creditor nation, she became the seat of the exchanges of the world. She naturally controlled the principal gold supplies, and was thereby better able to control these exchanges.

I believe there were two causes leading to the demonetization of silver by Germany. I believe that Germany wanted to place herself on terms of equality, commercially, with the English nation, and next, that her bankers were of the opinion that her interests should be regulated by gold, as a more convenient currency, and that one of the measures to be adopted to secure that end was the demonetization of silver. At the same time it was important that the newly-formed German Empire should have one definite money system and coinage.

For these reasons, principally, she has endeavored to demonetize silver, for the purpose of giving Germany only one kind of coin and a new money standard.

Mr. VANCE. Did not the German Empire at one time attempt to secure the demonetization of gold?

Dr. LINDERMAN. Without referring to some authorities I cannot answer that question with any precision. My opinion is that silver has been the money standard of the German peoples for many years before 1870. The commercial and monetary union with Austria and the other German states was very much mixed. It would not be proper for me to speak on this subject without referring to authorities.

Mr. MULDROW. I have been informed that such is the fact.

Dr. LINDERMAN. I will look it up for you, if I can find it.

Mr. RYAN. I would like to ask your opinion what would be the effect upon the price of silver bullion, as measured by the gold value of the coin, if silver be remonetized in the United States?

Dr. LINDERMAN. The tendency would be to strengthen the price as to the existing stock of silver bullion. If we were to open our mints to unlimited coinage, my view is that Germany would endeavor to place her silver upon our market, but not in sums likely to depreciate its value. The amount might reach forty millions, possibly, for the first year.

The coining capacity of the mints would not be sufficient to coin the silver which would come to us, but this would be neutralized in some respects by the fact that as soon as the bullion would be melted and assayed the depositor would be entitled to receive a certificate for the net value of his deposit, and the receipt which is issued to him, or his order, when the deposit is made, would constitute one of the best collaterals in the market. I think these receipts would be used in the same manner in which warehouse receipts are used, and would be a favorite collateral at the banks. They would, in fact, be in the nature of a representative of silver bullion actually on deposit in the mints, and would, to some extent, be used as money.

The act of March 3, 1863, requires the Secretary of the Treasury to receive on deposit gold coin and bullion in the Treasury, and to issue certificates therefor. While that meant, in the eyes of those who submitted and passed the law, only gold coin and gold bullion, under the

act to restore silver to an equality with gold coin I think the Secretary would find it very difficult to resist the issuance of coin-certificates for silver deposited in like manner. This is merely an opinion of my own, and I give it only because of the desire of the committee to have all the facts bearing on this question before it.

It would open a pretty wide market for silver. It would not restore the former ratio unless by a rise or increase in the value of silver or a fall in the value of gold, or both. I think the silver standard would prevail here, and that it, in its practical results, would be the establishment of a silver standard, and not a double standard or concurrent circulation of legal-tender gold and silver coins.

Then the next question I wish you gentlemen to consider is, should silver advance in value after the establishment of such a coinage to the rate which it held for many years prior to and up to 1870, and which corresponds to the ratio of fifteen and one-half to one, and the States of the Latin Monetary Union return to a silver coinage and open their mints, the result would be to make silver about three per cent. higher than it would be in our coinage, in which case our silver dollars would of course be exported.

Remonetization of silver is attended with great difficulties and uncertainties for the next two or three years. There are too many countries acting separately upon this subject to leave reasonable hope for an early solution of the question, or the restoration of the relative values of the two precious metals which existed before the change in the German money system, which is a matter earnestly to be hoped for, and well worthy the careful consideration of an international congress.

Mr. VANCE. The coinage of silver dollars would have the effect to appreciate silver, would it not?

Dr. LINDERMANN. I think so.

Mr. MULDROW. Would it depreciate the value of gold?

Dr. LINDERMANN. The argument of many gentlemen is that there will be a great scramble for gold by the European states. I do not see why a scramble for gold for coinage should result, when only four or five countries of the gold standard, all of which are well supplied with coin, are on a specie basis, and only one not on a specie basis is preparing to resume specie payments, viz., the United States, which has already a considerable accumulation for that purpose.

The value of silver and gold to day, relatively, is as one to seventeen and a quarter. If one ounce of pure gold will command seventeen and a quarter ounces of pure silver abroad, and only sixteen here, as would be the case if coined into silver dollars of four hundred and twelve and one-half grains, gold will go abroad and silver come to us.

As long as the price of silver in the principal markets of the world shall remain below the coining-rate in the United States, silver must come here, and if we have nothing else to give in return for it, gold must be exported in payment.

As to the probability of the price advancing to fifty-nine pence, which would correspond to the coining-rate in silver dollars, and make the gold dollar and the silver dollar equivalents, it would, to a great extent, be a matter of conjecture only.

It will probably take nearly two years for the German stock to be consumed, which, with the uncertain attitude of France and her monetary allies, complicates the question very greatly.

Then, the next thing to be considered is the amount of silver which India and China are likely to take within two or three years. They have taken the largest amounts in the last twenty-two months they

have ever taken in a corresponding period of time—over one hundred millions. My opinion is, they will take much less during the next few years, possibly not more than thirty millions. The Monetary Union between France, Italy, Belgium, and Switzerland will expire January 1, 1880. Then they will be at liberty to do what they please, whereas now they are not at liberty to change the existing double standard. In the mean time, they protect themselves against an influx of silver from Germany and other sources by keeping their mints closed to its coinage.

Mr. RYAN. Since 1873, has not gold bullion appreciated, and what is the cause of it?

Dr. LINDERMAN. As to the appreciation of gold and depreciation of silver, it would be very difficult for any man to determine exactly how much the one had appreciated or the other depreciated. The only way would be to take the general range of prices, say in 1860, in different countries, and compare the same with the prices at the present time.

I have not been able to find any authoritative data on which to make a comparison.

The majority report of the United States Monetary Commission endeavored to procure this information, but if they have it, it is not contained in the printed report. It may, however, come to us in the testimony and papers yet to be printed.

The views of the Monetary Commission in respect to a comparison of the gold appear to be based on a comparison of prices in 1873 with those of 1877. With due respect to the high authority of the commission, I consider a period of four years too short on which to base a comparison.

Mr. VANCE. You stated that probably forty millions might come here from Germany.

Dr. LINDERMAN. As long as the price of silver in London shall remain below the coining-rate in the United States, New York will be a better market for silver than London, and it will for some time, no doubt, come to us freely; anything like the precise amount cannot of course be estimated, but it is safe to say it will be quite large.

The CHAIRMAN. What is your opinion about the propriety of the government buying bullion?

Dr. LINDERMAN. As long as the price of silver is materially below the coining-rate of silver dollars there will of course be a seigniorage or gain, and which should undoubtedly be realized by the government as representing the people. There would be no seigniorage after silver should rise to fifty-nine pence, and then the government might coin with propriety for private parties at will.

Until prices generally shall adjust themselves to the new standard, the government as representing the people ought to realize the difference between the bullion and legal-tender value, which would no doubt be sufficient to defray the cost of coinage and of distributing the new silver dollar to the different parts of the country. Otherwise there would be a difficulty as to this coin finding its way into circulation, as private parties would not be willing to pay the expense of transportation to points at considerable distance from the mints.

Mr. DWIGHT. How much available silver have you on hand for the coinage of these dollars?

Dr. LINDERMAN. Not more than a million or two.

Mr. RYAN. The trade-dollars are four hundred and twenty grains, are they not?

Dr. LINDERMAN. Yes, sir; four hundred and twenty grains, instead of four hundred and twelve and a half grains, the weight of the old dollar. They are not a legal tender for any sum.

Should we adopt the silver coinage, we would enter the field with the great consumers of silver, India and China, and this would tend to establish a higher rate for silver, especially if the demand from those countries continues large. If we enter into this competition, the first result will be to bring all the bullion east of the Rocky Mountains to the Philadelphia mint for coinage.

Bullion can be put into China and sent to the Indies from San Francisco easier than from there by the way of London, and when a large demand exists, especially from China, the price in San Francisco will run up to the London rate and sometimes two per cent. above.

There are a good many elements in this question that no certain opinion can be given on, the ultimate effect of which cannot be conjectured with any degree of certainty.

Therefore I would say that it would be unsafe for this country to attempt to fix, at the present time, a permanent policy with regard to the coinage and use of silver as an unlimited legal tender. If silver is to be restored to the value it held relatively to gold in 1870, it must be with the aid of the so-called Latin States. And, as they cannot well depart from the ratio of fifteen and one-half to one, we must look ultimately for that ratio to prevail everywhere in the countries undertaking to use concurrently gold and silver legal-tender coins. As I have before stated the ratio of sixteen to one in the United States cannot be maintained concurrently with the unrestricted coinage of silver by the mints of the Latin States.

While I have pronounced views as to the standard which under existing circumstances should prevail in the United States, I try to keep my mind clear of prejudice, and would state that if in its wisdom the law-making power should decide to make silver an unlimited legal-tender, equally with gold, it should consider well whether the average price of silver from 1870 to 1878, which I make about fifty-seven and one-fourth ($57\frac{1}{4}$) pence, would not be the best basis on which to establish a legal-tender silver dollar, with the understanding and expectation that sooner or later its weight would be reduced to an extent sufficient to bring the ratio in this country the same as in France.

France, the principal country of the double standard, will be compelled, from the nature of the circumstances by which she is surrounded, to determine her policy within a year. Before that determination is reached the question should be considered by an international congress, in which we should join.

The gold or bullion value of a dollar based on fifty-seven and one-fourth pence would be something over ninety-seven cents, and, if the cost of coinage and of distribution be added, it would as a legal tender be more likely to maintain a concurrent circulation with gold and legal-tender notes than upon any other basis, and no injury would be inflicted either on public or private interests from all the coins that could be issued in one year—say forty millions.

The following letters were then read :

MINT OF THE UNITED STATES AT PHILADELPHIA,
Assay Department, January 16, 1878.

SIR : In accordance with the order from the Director, the alloy called "goloid" has been thoroughly tested here, both before and after coinage. I have the following statement to make as to its properties :

First, let me say, that it does not come within my province to speak of certain points which are claimed as advantages, such as : 1. That this mixture of gold and silver would destroy the rivalry between the two metals, and compel them both to be used in currency ; 2. The size of the dollar would be much reduced, as compared with the silver dollar ; 3. It would not be melted down to be used in manufactures. There is obviously much force in these points, and, of course, they will receive due consideration.

I now take up the matter technically. 1. Although a ternary compound—gold, silver, and copper—it mixes as well in melting as the standard binary alloy of gold and silver. We are constantly getting these triple alloys; only yesterday I reported a deposit which contained those three metals in nearly the same proportions.

2. The goloid is as ductile as standard silver, and would work as well in mintage.

3. Its specific gravity is a little above that of standard silver, being 10.28 in the ingot, and 10.50 after striking in a screw-press, which is the highest compression. Standard silver in the ingot shows 10.24, and when struck as above 10.33. The difference is due to the gold present, and would afford a test of genuineness in the hands of an experienced operator, with first-class balance.

4. Its color is precisely that of standard silver. So would it be if the gold were ten times as much. It is only as we reach nearly equal proportions that the yellowish tint appears.

5. Its sonority or *ring* is nearly the same as that of standard silver. The sound is more prolonged. But this very delicate test would be of no use to ordinary examiners.

6. It is acted upon by the usual acid solvents precisely as standard silver is; the goloid of course leaving a residuum of gold in powder. Neither mixture is touched by muriatic or hydrochloric acid, cold or hot.

7. Nothing can be said in advance about the *wear* or abrasion. There is no reason to expect any difference.

8. The danger of imitations, leaving the gold entirely out, would, of course, be very great. Assuming well-made false dies, there would be no test at all in the hands of ordinary dealers. Our own short test by acid mixtures entirely fails. Nothing would do but trying the specific gravity, which is slow work, and apt to be incorrectly done.

These are all the points which come within my range as an assayer. Judged by those properties, the goloid coin has no advantages. On the contrary, it would be held by scientific men everywhere as a retrograde movement. The study has been all along to get gold and silver as completely separated as possible. They are hardly in a merchantable shape while intermixed. For that reason, they would be parted as soon as exported, and they would be worth less by so much as the cost of parting, say 1 $\frac{1}{2}$ cents per dollar. Within the mint, the danger of getting the two metals, whether ingots or clippings, mixed up would require incessant watch. If it is adopted, standard silver, even for dimes, had better be banished. If goloid means like gold, it is certainly a misnomer, being not at all like it in appearance or substance. It might better be called silvcroid (or *argyroid* scientifically), because it looks and behaves like silver, and its largest component is silver. The coins formerly made in Tripoli and in Japan, of gold, silver, and copper, had the gold on the outside, and not hidden in the mass. A thick gilding would hold its own for a long time. In conclusion, I beg to correct an error which is stamped on the goloid specimen coin, that of calling it "nine-tenths (.9) fine." Standard gold is nine-tenths fine, and so is standard silver, but when the two are put together the term loses its meaning. It is like making an addition of six oranges and three apples; they cannot be made into one sum.

Very respectfully,

WM. E. DU BOISE,
Assayer.

I inclose a slip of goloid on which a gum-elastic band was laid for one day.

Hon. JAMES POLLOCK,
Superintendent, &c., &c.

UNITED STATES MINT, MELTERS AND REFINERS' DEPARTMENT,
Philadelphia, Penn., January 14, 1878.

SIR: I have examined the question raised by the Director of the Mint in his letter, to you of the 12th instant, relative to the value of the alloy proposed for the so-called goloid dollar, and herewith submit, as requested, my opinion in relation to it. As I understand it, the alloy is to be constituted in the following ratio:

	In thousandths.	In grains in the dollar-piece.
Silver.....	864	222 $\frac{9}{100}^{\frac{1}{2}}\frac{5}{5}$
Gold	36	9 $\frac{2}{100}^{\frac{8}{8}}$
Copper.....	100	25 $\frac{8}{100}^{\frac{0}{0}}$
	1000	258

The copper is put into the alloy to harden it, as in our usual standard gold and silver, and we may leave it wholly out of view.

We have, therefore, only to consider the alloy of the two metals, 864 thousandths of silver and 36 of gold, which, reduced to the simplest ratio, is as 24 silver to 1 gold (by

weight), or expressed in thousandths, without the alloying copper, is 960 thousandths silver to 40 thousandths gold. The doré silver, of which we refined over a half-million of ounces in 1876, had the composition of 946-932 thousandths of silver to about 42-54 thousandths of gold, with a balance of 10-15 thousandths of impurity, usually embrittling metals. Since the goloid alloy manifestly approximates to the ratio in the doré or Comstock bullion, can the latter be used for it?

1. The Comstock bullion could not be all employed directly to make goloid, because scarcely a bar of the metal would exhibit precisely the goloid ratio of 960 thousandths to 40 thousandths between its silver and gold, and yet the precision of modern coinage demands that we should not vary more than $\frac{1}{1000}$ (.001), that is, that the ratio might be from 961 thousandths silver to 39 thousandths gold to 959 thousandths silver to 41 thousandths gold.

In our actual practice, we allow in gold coin, as an extreme limit, only $\frac{3}{1000}$ of $\frac{1}{1000}$ (.0003) above or below the legal standard, on account of the great value of gold, and because of the importance of having as uniform a value as possible in that which is quoted as the most general and most fixed standard for comparison of values. For the same reasons, although in a less degree, the variation in goloid should not be more than $\frac{1}{1000}$ (.001) from the legal standard of $\frac{4}{1000}$ in gold (or 36 thousandths in the goloid coin, with its alloying copper).

Since this is not to be found naturally in the Comstock bullion, the latter must be brought to the exact ratio by the addition of pure silver or pure gold, which has been refined by acid, or by commingling Comstock alloys of varying proportions and in varying quantities, until the precise legal proportion is attained.

The latter will be found in practice to be so rarely attainable that the former method of adding fine metal would be adopted exclusively.

The Comstock bullion, then, in its natural ratio between silver and gold, must be supplemented by the addition of fine silver or gold refined by acid, so that there is no great advantage in the natural alloy in respect of the proportion between gold and silver.

2. Silver-mines containing gold do not always exhibit the same ratio between two metals in every part of their workings, and, moreover, are liable to great fluctuation at times. The metals are liable to change their ratios. Hence, there can be no certainty that in the Comstock mines the goloid ratio, or an approach to it, will be maintained for one, two, or more years, but it may change to such an extent that the Comstock bullion may cease to be of any special value for the goloid alloy. The question, then, might be simplified thus: Is there any peculiar advantage in the goloid ratio of 24 silver to 1 gold, independent of the present Comstock bullion? Other silver-mines containing gold exhibit an infinite number of ratios between their gold and silver, and are in like manner subject to alterations in those ratios in different parts of the mines and at different periods of time. Therefore, unless the goloid proportion of 24 silver to 1 gold has some peculiarly advantageous properties in it, the goloid dollar might perchance benefit the Comstock lode in its present condition, but would not prove beneficial to the rest of the world.

3. Auriferous silver-mines usually contain more or less of the embrittling elements, lead, bismuth, antimony, arsenic, &c., and although smelters are more or less successful in removing these dangerous companions, yet there are frequently sufficient traces of them left from the smelting operations to make the metal useless for coinage without repeated fluxings, in which there is always a risk of loss. We witnessed this effect in doré silver. Hence, it would be sometimes more effective, and at least equally economical, to refine auriferous silver by acid-parting than by mere fluxing. If it be necessary to resort to acid-parting, then there is no advantage whatever in the goloid proportion of gold and silver, unless it can be shown that it has inherent properties superior to that of our standard silver coin.

4. As mines change in different parts of their workings, and at different times, the relative proportions of their silver and gold, in like manner may change the relative quantities of their bases or embrittling ingredients. The ratios and nature of these last may change so unfavorably in the Comstock and other lodes as to make it more advantageous to refine the precious metals wholly by acid, which would, of course, render the goloid proportion useless except it possess inherent value.

We may then conclude that, because we cannot employ the pure gold and silver proportion as it now exists in the Comstock bullion for making goloid without the use of more or less gold or silver parted by acid, because this ratio may vary greatly in the Comstock lode in future, and varies indefinitely in other auriferous silver-mines, more certainly demanding largely or wholly parting by acid, because the dominance of embrittling metals now or in future in the Comstock and other mines may render parting by acid partly or wholly necessary; therefore, there is no advantage in having natural mixtures of gold and silver approximating at the present or at any time to the goloid proportion, unless there be some useful property inherent in that proportion, and in that alone.

5. What are the advantages of the goloid proportion of 24 silver to 1 gold? There

is no advantage in it that I am aware of, except in its greater value, as compared with the same bulk of coin of standard silver; that while the trade-dollar weighs 420 grains, the goloid dollar shall weigh 258 grains, or 3½ per cent. less, that \$10 in trade-dollars weigh nearly ¾ pound, \$10 goloid would weigh nearly ½ pound.

The substitution of 36 thousandths soft gold for the like amount of soft silver in the trade-dollar changes it into goloid without affecting any of its external properties, except its specific gravity. In its hardness, toughness, fusibility, malleability, color, and ring, there is no difference; and in its density the difference is so small that a very nice balance, with precision and care in weighing, will be requisite to ascertain whether a coin be goloid or standard silver.

I think that no ordinary machine could be contrived by which people in the usual walks of life could distinguish between goloid and our standard silver. The device on the coin alone could be employed to distinguish between them while the devices were clearly visible and not much worn.

6. The goloid coin might readily be imitated in similar alloys, varying only in the ratios between gold and silver. Thus one grain of silver might be substituted for one grain of gold, making the goloid dollar worth only 96 cents or 96½ cents, and nothing short of a fine assay could ascertain the fact.

Five grains of gold might be omitted from the goloid dollar and 5 grains of silver added, so that the total weight of 258 grains would be the same; the color, ring, and other external properties would be the same; in all probability the specific gravity would be 10.25 or 10.26 while that of unaltered goloid is 10.28 and of standard silver 10.24, a difference inappreciable except to the finest balance and manipulation; and yet such a goloid dollar would be worth only about 81½ cents. Would not such a margin of profit lead to dangerous counterfeiting, most dangerous because difficult and almost incapable of detection?

7. Under the most favorable view possible of making goloid from natural combinations without parting, it might be issued at the combined value of its gold and silver, without including the cost of parting, but as it would bear only international and commercial value abroad, it must be sold subject to a deduction for refining, which would necessarily be borne by the United States holders. When the United States demand for such coin is satisfied, which could be done in a short time, the vast possible overplus, if made into coin, would so overstock the market that the goloid coin would sink in value to the commercial level of its gold and silver, including parting charges. Then the apparent advantage of the goloid composition, as being the direct product of some of our western mines at the least expense, would altogether disappear.

8. I merely allude to the fact that a patent has been granted for the goloid alloy, but as far as my knowledge of the principles underlying patent-rights and of the properties of the goloid alloy allows me, I venture to express the opinion that no court would sustain the patent against a multitude of imitations of the alloy, consisting of the same metals in slightly varying proportions.

Respectfully yours,

JAS. C. BOOTH,
Melter and Refiner.

Hon. JAMES POLLOCK,
Superintendent.

MINT OF THE UNITED STATES AT PHILADELPHIA,
January 14, 1878.

SIR: Learning through you that the Director desired the views of the several officers in this institution upon the proposed goloid coinage, I have the honor, at your request, to state that I do not think such a coinage at all desirable.

There is no doubt, judging from the experimental pieces recently struck, that an alloy composed of 36 parts of gold, 864 parts of silver, and 100 parts of copper, is capable of easy manipulation. It works well, and readily receives the impressions made upon it.

It is objectionable, however, for a number of reasons: In the first place, there is no quick way of discerning the metal from our standard silver. Its color is not sufficiently changed to readily detect it. The evils arising from this one fact are many and great. The ease with which it could be counterfeited, by striking in standard silver, is a serious defect. Two hundred and fifty-eight (258) grains of standard silver is worth, in our subsidiary coin, sixty-seven (67) cents. A profit of thirty-three (33) cents on each piece would offer a great temptation to evil-doers. The weight would correspond with the goloid dollar; the jingle and color the same, and it would require an assay to determine the genuine from the counterfeit. A melter and refiner disposed to be evil could readily palm off on the coiner standard silver ingots for goloid; or this could be done through mistake, and the serious result of the mint issuing false coin would arise. Or a wicked coiner could readily find opportunity to issue standard silver for goloid

and use the latter to cover up peculations in his gold account. I see many evils in the practical working of a composition of the kind proposed, particularly in an institution where standard silver is so largely worked. It opens the door very widely to temptation and fraud. The great objection, that of affecting the credit of money with other countries, I leave for able minds to grapple. I might add that if the mint is to lose its revenue derived in the parting of gold and silver, because there can be silver ore mined, already alloyed with gold in the proportions required for goloid, then I see no reason why the owners of mines, who have ore of a different value, should not be accommodated with a dollar to suit their productions.

In conclusion, I wish to say that I have no desire to dictate to the authorities what the coinage of the country should be. I believe that the office of coiner is to make the coin provided for by the laws, not to decide upon its nature.

Very respectfully, your obedient servant,

E. C. BOSBYSHELL, *Coiner.*

Hon. JAMES POLLOCK,
Superintendent.

MINT OF THE UNITED STATES AT PHILADELPHIA,
January 16, 1878.

SIR: In compliance with your request of the 12th instant, received on the 14th, I herewith inclose official reports from the operative officers of this mint, with regard to the proposed "goloid" coinage.

I have myself never been able to see that any advantage whatever could be derived from "goloid" coinage, while the objections seemed to me to be numerous and insurmountable. Many of these objections are presented in detail in the special reports herewith forwarded, and in which I fully and entirely concur. Aside from all other objections the practical test furnished by a comparison of the pattern "goloid" dollar herewith inclosed struck by the coiner in standard silver, with the piece struck in the "goloid" alloy, in your possession, and the impossibility of distinguishing between them except by some special ear-mark, must be absolutely conclusive of the question. I shall add in justice to the melter and refiner that his report is the first draught prepared amidst other pressing duties, which will account for the interlineations. I inclose for payment the coiner's bill, 70 cents, for the pattern piece in standard silver herewith inclosed.

Very respectfully,

JAMES POLLOCK,
Superintendent.

Hon. H. R. LINDERMAN,
Director of the Mint.

MINT OF THE UNITED STATES AT PHILADELPHIA,
January 16, 1878.

The Director of the Mint to the coiner, Dr.

To one (1) standard silver goloid dollar..... .70c.

Received payment.

E. C. BOSBYSHELL,
Coiner.

MINT OF THE UNITED STATES AT PHILADELPHIA,
January 15, 1878.

SIR: I have the honor to transmit herewith a goloid pattern dollar struck in standard silver. I have had this struck in order to enable you and the Director to compare it with the pieces struck in goloid. A comparison will convince you, as it has me, of the utter impossibility of detecting goloid dollars from standard silver pieces. An examination of the letter "o" in the word "of," on the reverse of the silver piece inclosed will enable you to detect this piece from those struck in goloid, as in the silver piece it is defectively struck.

Very respectfully, your obedient servant,

E. C. BOSBYSHELL.

Hon JAMES POLLOCK,
Superintendent.

H. Mis. 24—2

MINT OF UNITED STATES,
Philadelphia, 11th, 1878.

SIR: In obedience to your request, I submit my opinion of the goloid dollar. I fail to see any advantages it presents in any of our processes of manufacture over silver, while it plainly offers additional temptation and facilities in counterfeiting, as the whole amount of gold could be omitted, and the effect of color (if any) made up by the substitution of oreide, or any of the close imitations of gold well known to the manufacturers of cheap jewelry, while the difference in weight could be compensated for by an imperceptible increase in thickness. I think also (but on this point you are better informed than myself) that it would be utterly rejected abroad, as the cost of separation would so lessen its value that it never could be used in the arts or manufactures, which, in ordinary coinage, consumes a very large amount by remelting for those purposes. In fact, I think that all of the objections that were so successfully urged against the platinum coins of Russia as to compel the withdrawal of them, would apply with equal force to this compound.

Very respectfully, yours,

W. S. BARBER,
Engraver.

WASHINGTON, D. C., January 25, 1878.

STATEMENTS OF E. B. ELLIOTT AND DR. WILLIAM WHEELER HUBBELL.

Mr. MAISH (to Mr. Elliott). I will ask you why this expression is used in your bill (H. R. No. 907), "shall weigh, for each dollar, one and two-thirds grams"?

Mr. ELLIOTT. One and two-thirds grams would be equal to five-thirds of a gram. It is difficult to express it otherwise with exact accuracy.

The CHAIRMAN. Why do you put it in this form?

Mr. MAISH. Why at this weight?

The CHAIRMAN. Why do you use a vulgar fraction instead of a decimal? Why not put it in a decimal form?

Mr. ELLIOTT. If you put it in the form of a decimal it would be an interminable one, but a simple one, one with which we are all well acquainted. It is a kind known as a simple repetend. The common fraction two-thirds expresses the whole of the fraction. The interrupted decimal form would leave an interminable remainder.

Mr. MAISH. Why, then, give it this weight? Is it not possible to give it another weight, expressed in decimal figures, which would not make an interminable decimal expression?

Mr. ELLIOTT. It is desirable that standard coins of different countries should have definite and simple relationship, both as to the weight of the entire coin and as to the weight of pure metal contained therein, with the destined international unit of weight, the metric gram; and if the standard coins of different values do each possess such simple relationship to the gram, they must of necessity possess as to weight and value simple relationship with each other, and computations will be greatly facilitated. If for the pure metal in the standard coins there should be adopted weights that do not possess simplicity of relationship with some common unit of weight, computation will of necessity, to a corresponding extent, become complicated and difficult. I know of no other weight to be given to the dollar, near its present weight, that has so simple a relation to the metric weight, both as regards the entire weight and the weight of the pure gold contained therein, as this.

You have the weight of a gram and a half gram of pure metal, and of one and two-thirds grams as the weight of the coin. I know of no weight that bears so simple a relationship to the gram or that would so greatly facilitate computation. The present gold dollar of the United

States weighs $1.6718 +$ grams, and contains of pure metal $1.50463 +$ grams. The proposed metric dollar weighs $1\frac{3}{8}$ or 1.6666 grams, and contains of pure metal 1.5 grams.

The CHAIRMAN. What baser metal do you use in your alloy?

Mr. ELLIOTT. Copper.

Mr. MAISH. Can you not increase the weight, say, to one and eight-tenths grams, thus having a decimal form of expression and still preserving the relationship with the proposed international system of coinage?

Mr. ELLIOTT. You can add more alloy and have such weight, but you have introduced an inharmonious element. It is generally conceded by nations, at the present time, that the simplest ratio of alloy to the pure metal is as one to ten. All our own coins of gold and silver, since the year 1837, have had that rate of fineness. All the coins that have lately been established by nations adopting the metrical system and improving their systems of coinage have adopted that ratio. Great Britain has eleven-twelfths fineness as her standard; one-twelfth copper and silver and eleven-twelfths pure metal—gold. But Great Britain is not unwilling to make a change and adopt the nine-tenths standard when there shall be sufficient reasons therefor, arising from her commercial relations with nations using the nine-tenths standard. The almost universally-accepted proportion of alloy is one in ten; nine parts of pure metal to one of silver or copper. To change this proportion would introduce an inharmonious element in respect to fineness. My impression is that we ought not to change this ratio. My impression is that the existing ratio of one-tenth of alloy to nine-tenths of pure metal for gold and silver should not be changed.

The CHAIRMAN. I suppose that one gram and six hundred and sixty-six one-thousandths (1.666 grams) would approximate just as near.

Mr. ELLIOTT. You do not get the weight exact, because there is a small remainder not expressed.

The CHAIRMAN. Is it not as easy to get sixty-six one-hundredths of any quantity as it is to get two-thirds; and would not it be as easy to say sixty-six one-hundredths of a gram as that it should be one and two-thirds grams, and as easy to make computations from that standpoint?

Mr. ELLIOTT. The gram with these decimals (.666) would differ but an insignificant amount from the gram and two-thirds of a gram.

Mr. MAISH. You state the difference expressed by the fraction; practically you cannot get one-third or two thirds of anything.

Mr. ELLIOTT. One gram and six hundred and sixty-six one thousandths would differ but by an insignificant amount from one gram and two-thirds of a gram.

The CHAIRMAN. For practical purposes would it make any difference?

Mr. ELLIOTT. There is no difficulty in making a coin that shall approximate any amount you want. The mint can do anything you wish it to do. The main question is what will facilitate computation. What will be the most easy method of securing a general harmony, with a view of bringing our coinage into relationship with the metric standard of weight and with the coinage of the nations with which we have commercial relations.

The CHAIRMAN. Cannot that be obtained as well with the expression one and sixty-six one-hundredths as it could be with the expression one and two thirds?

Mr. ELLIOTT. If you require a school-boy to solve the problem with

one instead of the other he would soon find the difference. With the decimal he would have difficulty; with the common fraction two-thirds he would find none. Two-thirds is ten-sixths. He will multiply by ten and divide by six, or divide by ten and multiply by six, instead of multiplying or dividing by 1.666. The different operations would not produce a result appreciably different. It would be entirely within the limits of "tolerance" or allowances. But in selecting a standard for computation, we should avoid complexity as far as possible. You have a mass of gold of nine-tenths fineness—the ordinary fineness—you know its weight in grams. In order to determine its value in dollars—six-tenths of the weight is the value in dollars, six-tenths exactly, under the system as it now rests in the bill—if you were to say that six-tenths of the number of grams was the value in dollars, that is exact, but not so with the other formula if, instead, you multiply by .666, and, besides, that is awkward. The two results, however, would not be appreciably different. The better plan would be to adopt the more practical method. The decimal expression suggested by the chairman is exact, if a dot be placed below each of the last two figures to denote that the fraction was a "simple repetend," so called, and that the figures so dotted were to be continued indefinitely; thus, 1.666 denote 1.666, and so on indefinitely.

Mr. MAISH. Can you not obviate the use of the expression two-thirds and yet preserve the present rate of fineness—nine-tenths? If so, how?

Mr. ELLIOTT. By omitting the mention of the weight of the coin.

Mr. MAISH. Then you would not state the fineness at all?

Mr. ELLIOTT. Yes; nine-tenths pure gold and the remainder one-tenth alloy, without regard to the weight of the coin.

Mr. MAISH. You would not express its weight on the coin?

Mr. ELLIOTT. No, sir; only its value and fineness. The relative proportions of gold and alloy would be universally known; and if not, the expression nine-tenths fine would show that the weight of the coin was one-ninth greater than the weight of the pure gold. Instead of "1 $\frac{2}{9}$ grams, $\frac{9}{10}$ fine," stamped on the coin, the inscription may be "1.66 grams, $\frac{9}{10}$ fine"; the fraction is a simple repetend, the figures to be continued indefinitely.

Mr. MAISH. You could express the diameter?

Mr. ELLIOTT. You can do it. Yet with the weight of the gold alone and the rate of fineness you have defined the weight of the coin. No other definition is necessary.

Mr. MAISH. I do not see that you have expressed the weight of the dollar?

Mr. ELLIOTT. No, but we have the weight of the pure metal. We could say, however, that the kilogram shall be coined into six hundred dollars of nine-tenths fineness. The present standard of 598 leaves an interminable fraction. You can say instead of two-thirds—you can put the proportion of the alloy to the entire weight of the metal as one to ten; you can omit, if you please, this fraction, and say that it shall be of such a weight and fineness that from a kilogram of gold of nine-tenths fineness there may be coined six hundred dollars.

Mr. MAISH. Will you make out the formula showing how that is possible?

Mr. ELLIOTT. Yes, sir.

Mr. MULDROW. You leave out the weight of the dollar altogether.

Mr. ELLIOTT. We can get at the matter so as to furnish the formula without the use of this fraction.

The CHAIRMAN. It seems to me that the end might be obtained by saying that it should weigh one gram and one-half of a gram of pure gold.

Mr. ELLIOTT. Yes; if united with the statement that the coin is of nine-tenths fineness.

Mr. MULDROW. The alloy might be lighter.

The CHAIRMAN. And its weight be altered?

Mr. ELLIOTT. It should contain, by weight, one part of alloy to nine parts of pure metal. The definition of the weight of the pure metal would thus furnish the weight of the dollar.

Mr. MULDROW. If you have one and one-half grains in the piece and one-tenth alloy, would not the two be in proportion? That does away with the fraction one and two-thirds grams.

Mr. ELLIOTT. Certainly. Every one will know that the entire weight will be one and two-thirds.

Mr. MULDROW. You say that under that form there would be nothing on the coin not compatible with the metrical system?

Mr. ELLIOTT. The term nine comes in in order to show the quantity of pure metal.

Mr. MULDROW. Do not you think, Mr. Chairman, this form would be more desirable?

The CHAIRMAN. I think so.

Mr. MULDROW. We want to reconcile this coin with the metrical system, to express it decimally. Suppose you have a decimal expression for the one-half?

Mr. ELLIOTT. You can have that. It would be one and five-tenths grams, but in using the other in a decimal form of expression you would have a fraction of a much worse kind than a simple repetend.

The CHAIRMAN. How would this do: "one and one half grams pure gold, one-tenth alloy, nine-tenths fineness"? You have the weight and preserve the decimal form of expression. "The dollar shall consist of one and five-tenths grams of pure metal and one-tenth alloy."

Mr. ELLIOTT. Yes; that is one form. "The metal shall consist of nine parts of pure gold to one part of alloy; and the dollar shall contain one gram and one-half of a gram of pure gold." This would express it; or "the dollar shall contain of pure gold one and one-half grams, and the proportion of the alloy to the entire weight shall be as one to ten." That obviates the use of the expression one and two-thirds. If you strike out in your bill the words "shall weigh one and two-thirds grams," and substitute the words suggested, so that it shall read, "the gold hereafter coined by the United States shall contain for each dollar of denominational value one and one-half grams of pure gold"; strike out "and shall weigh for each dollar one and two-thirds grams," and substitute "the proportion of alloy to the entire weight shall be as one to ten," instead of "being thus kept as ten to one."

Mr. MULDROW. Run your pencil through the bill and make it conform to your idea.

Mr. ELLIOTT. I will give the rate of pure gold that the coin shall contain, one and one-half grams pure gold, and that the proportion of alloy to the entire weight shall be as one to ten. The next question is, "What should be stamped on the coin?" In the definition we have an interminable decimal. Were we to stamp the exact weight of this coin on it it would be one and two-thirds. The weight of pure gold in the twenty-dollar coin, the ten-dollar coin, the five-dollar coin, and the three-dollar coin, all can be expressed decimally. The three-dollar coin has hitherto been issued in small amounts, but will be issued because it is

suitable and of easy comparison with the ten-dollar. The weight of the three-dollar piece is five grams, and its weight expressed decimals is unobjectionable. You can stamp upon the twenty-dollar coin thirty grams pure gold, or thirty-three and one-third grams for the weight of the entire coin. This is the principal gold coin we shall circulate. It is the principal gold coin now issued, and will probably continue to be the principal one, unless the three-dollar coin may partially supplant it, being adapted to a coin which Europe may possibly adopt—the decagram of gold, nine-tenths fine.

The CHAIRMAN. How about silver?

Mr. ELLIOTT. There will be no need of the fraction in the silver in our present coinage—subsidiary coin—twenty-five grams to the dollar.

The CHAIRMAN. Make it standard silver, because we are going to pass the silver bill.

Mr. ELLIOTT. The simplest way in regard to silver—

The CHAIRMAN. Say four hundred and twelve and one-half grains; give us that in grams.

Mr. ELLIOTT. 26.729567 grams weight, of which 24.056610 grams is pure silver. The word tergram for gold coinage will relieve the question as to the expression of the weight of the gold dollar from all objection. Would there be any objection to the word "tergram?" In the gold dollar there would be five tergrams, nine-tenths fine; in the double-eagle, one hundred tergrams; in the ten-dollar piece, fifty tergrams; in the five-dollar piece, twenty-five tergrams.

Mr. MULDROW. Why could it not be expressed in this way: That there shall be so much pure gold in grams, and so much alloy—one-tenth of the quantity of pure gold?

Mr. ELLIOTT. Well, we would have that interminable decimal. The alloy would be one-ninth of the weight of the pure gold, not one-tenth; one-tenth of the entire weight, but only one-ninth of the weight of pure metal. You divide the whole into ten parts; one of these represents the alloy.

Mr. MULDROW. Why cannot that be stamped on the coin, showing the precise weight of the pure gold in grams and the weight of the alloy?

Mr. MAISH. The tergram is not very well understood, but involves some difficulty.

The CHAIRMAN. What do you think about abolishing the gold dollar and using eagles and double eagles?

Mr. ELLIOTT. I have little, if any, objection to that.

Mr. MAISH. What is this six-dollar coin you propose?

Mr. ELLIOTT. It contains a decagram of standard gold, nine-tenths pure. I have a three-dollar piece. It weighs almost exactly five grams. One of our three-dollar coins would really weigh about five grams. They would weigh a trifle more, but it is worn. It is a three-dollar piece.

Mr. MAISH. Is that the coin about which Dr. Farr wrote?

Mr. ELLIOTT. No, sir. He recommended the decagram. The proposed three-dollar piece is a half-decagram of gold of nine-tenths fineness.

Mr. MULDROW. Is the gold dollar a very useful coin?

Mr. ELLIOTT. It is not used much. It gives a great deal of trouble at the mints. If the mint authorities were consulted, they would, I think, sooner drop the dollar than any other coin.

Mr. MAISH. What is the weight of this (the goloid dollar)?

Mr. ELLIOTT. This weighs fifty tergrams and a trifle over. Our ten-dollar gold piece is almost exactly fifty tergrams. This coin is based

on our gold coin, because the ratio of one to sixteen, as existing under our system between gold and silver, is preserved. It contains one grain of gold to twenty-four grains of silver. This contains 40 per cent. in value of gold and 60 per cent. of silver, making 100. It weighs almost exactly fifty tergrams, the weight of the gold being to the silver as one to twenty-four. It has the same weight as the eagle, and the value of the gold contained in it is forty cents. It would weigh, in milligrams, 16.718.

Dr. HUBBELL. In the metric system, making the gram the unit is mere nomenclature. We should preserve the expression milligram. I have prepared a bill which will meet this entire difficulty.

The CHAIRMAN. Please read it for the benefit of the committee.

Dr. HUBBELL. I am indebted to Mr. Elliott for a large portion of the information derived. I find it can be done without using the word "tergram." The expression nine-tenths showing the fineness is strictly metrical and decimal.

Mr. MAISH. You say that the metrical system is decimal?

Mr. ELLIOTT. It is substantially decimal. The present bill divides the gram of nine-tenths gold into six parts, ten of which make a dollar.

The Latin Union divides the gram of nine-tenths gold into thirty-one parts, ten of which make a franc.

The German Empire divides the gram into a still more complex number of parts, to wit, into 25.11 parts, ten of which make a mark.

The Scandinavian nations (Sweden, Norway, and Denmark) divide the gram into 22.32 parts, ten of which make a crown.

It will be seen that, as compared with the divisions of the gram by the so-called metric countries of the Latin Union, the German Empire, and the Scandinavian nations, the proposed division in the bill now under consideration is extremely simple. It cannot practically be made more simple.

It is desirable to compare values expressed in weights of *pure* gold with values expressed in weights of *standard* gold (and the reverse), and such comparison necessarily involves multiplication and division by nine, or by one of its component factors, three.

If coins were made of *pure* gold this reciprocal multiplication and division by nine or three could be avoided, but coins are *not* made of pure metal. The pronounced judgment of mankind is that alloy *must* be combined in order to give the requisite hardness and prevent abrasion. The pure metal is too soft and liable to rapid reduction in weight through wear.

The proportion of alloy to pure metal which best facilitates computations is as one to nine, making the alloy one-tenth of the entire weight, and the pure metal nine-tenths of the entire weight. The weight of pure metal proportioned to the entire weight is then as nine to ten. This last form of the ratio is the *simplest possible* for computation, involving only multiplication and division by the simpler number, three, instead of by the larger number, nine.

The metric dollar proposed will contain of pure metal one and a half, or three two ($1\frac{1}{2}$ or $\frac{3}{2}$) grams and will weigh five-thirds or ten-sixths ($\frac{5}{6}$ or $\frac{10}{6}$) grams. Therefore to convert weights of standard metal expressed in grams into metric dollars all that will be required will be to multiply by six-tenths ($\frac{6}{10}$), and, conversely, to convert values expressed in metric dollars to weight in grams of standard metal, to multiply by ten and divide by six, or by $\frac{10}{6}$.

Again, to convert weights of pure metal expressed in grams to metric dollars, multiply by $\frac{2}{3}$ (that is, multiply by two and divide by 3),

or conversely, to convert values expressed in metric dollars to weight in grams of pure metal, divide by $\frac{3}{2}$ or multiply by $\frac{3}{2}$ (that is multiply by three and divide by two). These processes, of course, are all easily understood and applied.

In our present system, instead of the simple form of $\frac{1}{10}$ or $\frac{2}{3}$, the factors are 5.98153 and 0.664615, respectively; numbers exceedingly difficult for ordinary minds to remember, or on occasion to apply.

The simplest process now to make these conversions in our existing system is, *first*, to make the reduction according to the proposed metric system; and, *secondly*, to add or subtract, as the cases may be, to or from the result three-tenths of one per cent. ($\frac{3}{10}$ of 1%) of such result, or, more accurately, three hundred and eight one hundred thousandths (.000308) of such result.

The bill suggested by Dr. Hubbell, to regulate the coinage, was then read as follows:

SIR: H. R. 2690, within, is the bill in print I prepared and presented to the committee, embodying my views of a regular, entire system of coinage for the United States.

WM. WHEELER HUBBELL.

Hon. ALEX. H. STEPHENS,
Chairman Committee on Coinage.

A BILL to establish the metric system in the coins of the United States of America, and provide for and regulate the coinage.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the coin of the United States shall be established and designated on the metric system, as follows: The one-cent piece shall be the lowest denominational unit, and the one-dollar piece shall be highest and only other denominational unit equivalent to one hundred cents. The one-cent piece shall be stamped "1 cent"; the twentieth part of a dollar shall be stamped "5 cent"; the tenth part of a dollar shall be stamped "10 cent"; the quarter of a dollar shall be stamped "25 cent"; the half of a dollar shall be stamped "50 cent"; the dollar shall be stamped "100 cent"; all in figures preceding the word "cent"; and the dollar shall contain the words "one dollar." The dollar shall be the denominational unit of all coin of greater value. The half-eagle of gold shall be stamped "five dollar"; the eagle of gold shall be stamped "ten dollar"; the double eagle of gold shall be stamped "twenty dollar."

SEC. 2. The metric weight of all coin above the five-cent piece shall be stamped thereon in figures denoting the weight thereof in milligrams, with a decimal point to denote grams, and the letters "mgs" to denote milligrams; but no appreciable variation shall be made in the weight of the coin, as heretofore provided by law in Troy grains, the milligram being a metric measure within the variable allowance now tolerated in coinage.

SEC. 3. The weight of the same coin shall also be stamped thereon in Troy grains, respectively, in figures and letters, "grs" to denote grains, together with the letter "S" to denote silver, and the letter "G" to denote gold, and the fineness of the metal stated in suitable figures, with the letter "F" to denote fine; and the proportion of standard silver and of standard gold in the coin shall be stated in figures thereon.

SEC. 4. The ninth section of the act of January eighteenth, eighteen hundred and thirty-seven, entitled "An act supplementary to the act entitled 'An act to establish a mint, and regulating the coins of the United States,'" and which declared four hundred and twelve and a half grains of silver, nine hundred fine, to be a lawful dollar of the United States, is hereby declared as continuing in full force and effect in relation to said dollar; and such silver dollars are lawful money and a legal tender in payment of all debts, public and private, not exceeding one hundred dollars in amount; and the coinage of said silver dollars is hereby authorized and directed. And it shall not be lawful to make any contract for a loan of money, or of notes issued by authority of the United States, discriminating in favor of one kind of money as against another kind of money so issued, except as expressly provided by law: *Provided*, That all loans may be contracted to be repaid in the same kind of money actually loaned.

SEC. 5. There shall be coined one-hundred-cent coins, or dollars; fifty-cent coins, or half-dollars; twenty-five-cent coins, or quarter-dollars; and ten-cent coins, or dimes, consisting of eight hundred and sixty-four thousandths parts of pure silver, thirty-six thousandths parts of pure gold, and one hundred thousandths parts of pure copper, distinguished as a new coin-metal by the term "goloid," to signify containing gold,

and compounded and finished on the principle patented and invented by W. W. Hubbell, May twenty-second, eighteen hundred and seventy-seven. The dollar of goloid shall be of the weight of two hundred and fifty-eight grains, or sixteen thousand seven hundred and eighteen milligrams; the half-dollar of goloid shall be of the weight of one hundred and twenty-nine grains, or eight thousand three hundred and fifty-nine milligrams; the quarter-dollar of goloid shall be of the weight of sixty-four and a half grains, or four thousand one hundred and seventy-nine and one-half milligrams; the ten-cent piece, or dime, of goloid shall be twenty-five and eight-tenths grains, or one thousand six hundred and seventy-one milligrams; and said coin shall be a legal tender, public and private, for any sum whatever, except duties on imports, fifty per centum of which may be paid in goloid coin, and fifty per centum in gold coin, or the whole of which may be paid in gold coin.

SEC. 6. The entire and only coinage of the United States shall consist of one-cent pieces of copper and five-cent pieces of nickel, as now provided; and ten-cent, twenty-five-cent, fifty-cent, and one-dollar pieces of goloid; one-dollar pieces of silver, denominated trade-dollars, one-dollar pieces of silver of four hundred and twelve and a half grains, nine hundred fine; gold coin of half-eagles, or five dollars, gold coin of eagles, or ten dollars, gold coin of double eagles, or twenty dollars, now provided by law.

SEC. 7. Any of the silver coin now in use except trade-dollars may be changed at the mints or Treasury for the same denominations of the coin authorized by this act, and their difference in value as bullion charged to the seigniorage-profit fund; and if a deficiency exists, then it shall be charged to a deficiency-bullion fund.

SEC. 8. The gold and silver coin belonging to the United States may be used to coin the goloid coin, and the Secretary of the Treasury is hereby authorized to set apart and maintain a fund of ten millions of dollars as a "bullion fund" for the purchase of gold and silver as needed for coinage.

SEC. 9. The penalty of counterfeiting any of the coin of the United States is hereby increased to not less than ten years and not more than twenty years for each offense, and a fine of not less than five thousand dollars nor more than twenty thousand dollars for each offense.

SEC. 10. The Secretary of the Treasury is hereby authorized to purchase the right of the patent for the goloid-coin-metal and the process of mintage from W. W. Hubbell, and pay for the same, out of the seigniorage derived from the coinage of the goloid coin, not exceeding a rate of one mill on the dollar of such coinage.

SEC. 11. The design of the coinage of the ten-cent, twenty five-cent, fifty-cent, and one-dollar pieces, shall be on the obverse a figure-head of "Liberty," bearing this word, surmounted by the words "E Pluribus Unum," and the thirteen stars of the original States displayed at the sides, with the date of coinage and denomination in figures; on the reverse, a circlet of stars, the words "United States of America," the denomination in letters, and the weight, name, and nature of the contents of the coin within the circlet. The gold coinage of five dollars or half-eagles shall bear the upper half of an eagle; the eagle of ten dollars shall bear the full eagle; and the double eagle shall bear a design of double eagles, and the denomination of the coins in words, all on the reverse, with the words "United States of America," and on the obverse the figure-head of "Liberty," and "E Pluribus Unum," date of coinage, and thirteen stars, and denomination of the coin in figures.

WASHINGTON, D. C., January 26, 1878.

STATEMENTS OF DR. H. R. LINDERMAN, DIRECTOR OF THE MINT, MR. FREDERICK ECKFELDT, AND DR. WILLIAM WHEELER HUBBELL.

DR. LINDERMAN. Mr. Chairman, in response to your second letter respecting the goloid dollar, I have five specimens to be placed in your hands, or the hands of any other that you may direct, to be returned, however, to the mint to be defaced, as it would not be advisable to multiply the number of them. We felt compelled to refuse the request of the members of the Committee on Banking and Currency for specimens of them.

Mr. Eckfeldt will submit his statement, and that will be my statement.

MR. ECKFELDT. The planchets for these pieces (the goloid dollars) were cut from strips prepared and cleaned, after the formula prescribed

by Dr. Hubbell, with vinegar, ammonia, whiting, buckskin, and brush. They were not touched by acid, and after they were annealed were cooled in pure water so that there could be no difference in the color of the metal on the outside from the inside—that they should have uniformity of tint. [One of the planchets exhibited to the committee.] I have a piece also of the alloy as rolled from the strip. The pieces were made because Dr. Hubbell proposed to bring out a golden tinge by the use of muriatic acid, whiting, and brush. One-half of this alloy was immersed for ten minutes in concentrated muriatic acid, and washed with ammonia, and polished with whiting and buckskin; and if any person will examine it they will see that there is no difference between it and the piece not touched by the acid. The planchets were cut out from a piece of that strip. It is merely the ingot rolled out. It has not been annealed or heated. There has been nothing done to it. The alloy was prepared from portions of gold, silver, and copper.

The CHAIRMAN. Was that [indicating the piece] subjected to the acid?

Mr. ECKFELDT. One-half of that was put in the acid.

Dr. HUBBELL. How long before you put it in the ammonia, after using the acid?

Mr. ECKFELDT. Not more than two or three minutes.

Dr. HUBBELL. It should lie some time so, that the oxygen of the air can have a chance to act on it.

The CHAIRMAN. You stated that you had other specimens of the alloy?

Mr. ECKFELDT. Yes, sir; four others were made containing variable portions of gold and silver, so as to illustrate the difference which the admixture of gold in the alloy would make. The first of these contains fifty parts of gold out of one thousand parts; the second one hundred parts of gold out of a thousand; the third one hundred and fifty parts; and the fourth two hundred parts in a thousand of gold. These are the four specimens, and there is no difference in the color. [The four strips were here exhibited to the committee.] If not for the marks upon them, I might be at a loss myself to tell the difference between them. There is a piece of "goloid" belonging to Dr. Hubbell, assayed by his permission. He can make his statement with reference to it. The fineness is stamped upon the piece.

Dr. HUBBELL. What does it assay? I took your own coin to make it. If my formula had been followed it would have been a dark color.

The CHAIRMAN. I have nothing further. Dr. Linderman has stated all that I wished him to. He states that he has made that according to the formula.

Dr. HUBBELL. You say that this strip has been in the muriatic acid?

Mr. ECKFELDT. Yes, one-half of it.

Dr. HUBBELL. It was not subjected to the action of the atmosphere for any considerable time; the acid was washed off?

Mr. ECKFELDT. Yes, before putting it into the ammonia.

Dr. HUBBELL. Did the action of the ammonia affect it?

Mr. ECKFELDT. I could not see any difference.

Dr. HUBBELL. Did you test this? If you had allowed it to lie so that the oxygen of the air would have united, it would have changed the chemical nature. Did you test that?

Mr. ECKFELDT. Muriatic acid will not oxidize silver. It will chloridize it.

Dr. HUBBELL. You say that this (the strip) is "goloid" metal?

Mr. ECKFELDT. Yes.

Dr. HUBBELL. It, the muriatic acid, did not touch this—you mean pure silver?

Mr. ECKFELDT. I do not; I have not tried pure silver.

Dr. HUBBELL. Do you mean it would not oxidize the silver coin of the United States?

Mr. ECKFELDT. I have never tried putting muriatic acid on coin. That black on the coin is not the oxide of silver. It may be chloride, darkened by exposure to sunlight.

Dr. HUBBELL. This is the goloid, and the muriatic acid did not touch it?

The CHAIRMAN. That is what he stated.

Dr. HUBBELL. Can you see any appearance of a gold tinge on it?

Mr. ECKFELDT. No, sir; I have examined it, and I cannot. [On being shown a piece of goloid that was assayed, and asked "What is that yellowish tinge? That may be more a reflected light. It is not tinged in the alloy. I do not see what would give it a yellowish tinge. It may be a reflection of the light. I am satisfied that the gold, that the forty-five parts of gold in that piece, cannot give it any golden color, because here is a piece with two hundred parts of gold in one thousand, and it is as white as silver. I might have had a piece made with three hundred parts in a thousand, for, unless brought out by acid which eats out the silver, the gold would not be perceptible, just as a jeweler will make a piece of inferior gold look like fine gold.]

Dr. HUBBELL. How long was this [the strip] fused before it was put together?

Mr. ECKFELDT. It was only fused long enough to thoroughly incorporate the metals. If it had been left to stand any length of time, a portion of the copper would have been removed by oxidization and the tenth part of copper would not have remained.

Dr. HUBBELL. Then, the proper amount of copper would not be there?

Mr. ECKFELDT. If it were not it would be known by the assay.

Dr. HUBBELL. Has not copper a color which is imparted to, and which changes the color of, the metal with which it is incorporated?

Mr. ECKFELDT. Pure silver has what we call the silvery color—a color known otherwise as the silver tint.

The CHAIRMAN. I do not think it is of any use to go on with this examination.

Mr. ECKFELDT. By the addition of one part of copper it gives a nine-tenths tint, the same color that "goloid," according to the formula, would have. It is quite a technical distinction—the nine-tenths tint. It has not the white appearance of pure silver.

Dr. HUBBELL. The combined copper and gold, have you discovered whether that produced a change in the color?

Mr. ECKFELDT. Combined copper and gold makes a much greater difference than copper and silver. Understand me; when I speak of gold and copper, I mean that we would take pure gold and alloy it with copper. You can bring out almost the color of copper. A piece of standard gold with one-tenth copper is nearer the appearance of copper than of fine gold.

Dr. HUBBELL. If you have combined copper and gold with silver, have you discovered any variation in the color when taking as small proportions as in "goloid"? In what proportions have you discovered the variation in the color?

Mr. ECKFELDT. In the mint they only make one alloy of either gold or silver; that is known as standard, and the only one recognized as

gold. No other alloys are made there. A jeweler could tell you better than any one else.

The CHAIRMAN. I understand you that you do not perceive any difference in the color where there is fifty thousandths and where there is two hundred thousandths of gold.

Mr. ECKFELDT. I cannot see it. I only know the difference between these pieces by the numbers. But for them I could not tell the difference between them.

Mr. MAISH. Have you weighed this coin (the goloid dollar)?

Mr. ECKFELDT. I have not weighed them. I saw them adjusted. I saw them from the melting of the metal to the striking of the pieces.

Mr. MAISH. Do you know what the specific gravity of the metal is as compared with silver?

Mr. ECKFELDT. It is so close to the specific gravity of silver that it would require most delicate scales and a most skillful manipulator to detect the difference.

Mr. MAISH. The specific gravity of silver is less than gold?

Mr. ECKFELDT. Yes, sir; considerably.

[In reply to a question asked by Mr. Clark, Mr. Eckfeldt made the following statement:] The specific gravity of an alloy of gold, silver, and copper differs from the mean of the specific gravity of the metals alone or separately.

The CHAIRMAN. Is it greater or less than the mean?

Mr. ECKFELDT. It is less. It follows a certain law, but I do not remember the exact specific gravity of goloid.

Mr. MAISH. I asked you, in reference to "goloid," whether the specific gravity of this "goloid" is greater than that of silver. You answered that it was so little greater than pure silver as to be difficult to detect it.

Mr. ECKFELDT. I meant than pure silver; that it would require delicate scales and a skillful manipulator to detect it, so close was the specific gravity of one to the other.

Mr. MAISH. Suppose you have a hundred pieces made in a combination of the metals with gold and silver pure. The specific gravity of gold being the greatest, can they be so thoroughly mixed that when you make the hundred pieces you can tell how much is in each piece?

Mr. ECKFELDT. There is no trouble at all about that.

Dr. LINDERMAN. Mr. Chairman, I have prepared a draft of a bill to submit to you, entitled "A bill to authorize the withdrawal from circulation of worn fractional currency." I will read it:

SECTION 1. Resolved by the Senate and House of Representatives in Congress assembled, That the fractional silver coins, when reduced in weight by natural abrasion to an extent rendering the inscription illegible, or the pieces otherwise unsuitable for circulation, shall, under regulations to be prescribed by the Secretary of the Treasury, be received at the several coinage mints at their nominal value in exchange for new fractional silver coins of the denominations authorized to be issued by law, and the difference between the bnlion-value of the worn coins received and the new coins paid in exchange therefor shall be defrayed from the silver-profit fund.

SECTION 2. Worn silver coins received at the mints under the provisions of this act shall be melted and recoined.

I want to call your attention, in connection with that, to what is causing a great deal of trouble. The attention of Congress should be called to it. I refer to the coins which have given the post-office so much trouble. These small silver pieces known as postal currency were coined of seven hundred and fifty parts of silver and the balance of copper, by authority of an act passed in 1851. In 1853 the standard was changed to nine hundred parts of silver to one hundred of copper.

[A quantity of these coins exhibited.]

Mr. DWIGHT. In what way does the postmaster dispose of them?

Dr. LINDERMAN. They send them to the Treasury. I borrowed these [exhibiting a quantity of five-cent silver coins] from their collection of five-cent pieces, to call your attention to them in connection with the measure which I propose in that bill. I will leave you a copy of my report made in 1875, and turn down the page from which I read. The renovation of small silver coins is provided for by law in Great Britain, the German Empire, the Latin Union, Norway, Sweden and Denmark, and the Netherlands; some of them have fixed four per cent. of loss as the rate at which they should be received for recoinage. They are to be redeemed at no other place but coinage mints. These coins have no artificial reduction in weight. It is not likely that any one would attempt to change these poor miserable coins. Whatever rate you choose to fix for loss by abrasion, why all right. Nine-tenths is now the fixed standard of all the principal nations except Great Britain and Russia.

NOTE.—The following memoranda are gathered from the laws and regulations of different countries as to the renovation and calling-in of worn subsidiary coins:

GREAT BRITAIN.

* * * The silver coinage is issued through the medium of the Bank of England, who are able, as in the case of gold, to judge from the amount in their possession and the demands made upon it as to what times and in what quantities fresh supplies will be required for circulation. As, however, silver is a token-coinage, representing more than the intrinsic value of the metal used in its manufacture, it is coined for the profit of the state, and not from metal brought in, as in the case of gold, by the public. Silver bullion for coinage is purchased with sums advanced to the master of the mint, from time to time, from the consolidated fund, by the Treasury, under the ninth section of the coinage act.

The advantage of making silver a token-coinage has been shown in a former portion of this report, and it is evident that, if under the existing law silver were coined on demand for persons bringing it to the mint, the profit on the transaction would hold out so great an inducement to the public to offer it for coinage as to lead in a short time to an inordinate amount of coinage, and to the consequent depreciation of that part of the currency. This profit, then, levied as a seigniorage, with the profit already mentioned, accrues as of right to the state; but, on the other hand, it becomes equally the duty of the state to withdraw from circulation, at its own expense, all silver coins which may become worn and unfit for further use. This withdrawal is effected through the Bank of England, who undertakes the "garbling" or sorting shillings and sixpences, and of returning the worn pieces periodically to the mint. The worn coin is received by the mint at its nominal value, and a vote of £15,000 a year is annually taken in the mint estimates for the loss on its recoinage. So far as England is concerned, this arrangement insures a constant supply of good silver coin, and the withdrawal of coins which have become unfit for circulation. * * * There is no least current weight for silver coin. As silver is a token-coinage, the withdrawal of silver coin is undertaken by the state. * * * *British Mint Report, 1870.*

MONETARY TREATY CONCLUDED DECEMBER 23, 1865, BETWEEN FRANCE, BELGIUM, ITALY, AND SWITZERLAND.

* * * The small silver coins must be withdrawn from circulation as soon as they have lost by abrasion 5 per cent. below the legal allowance. The pieces are to be recoined by the government issuing them when they shall have been reduced by usage 5 per cent. below the minimum, or when their stamp shall have been effaced.

GERMAN EMPIRE.

* * * National silver, nickel, and copper coins which, by long circulation or use, have lost considerably in weight or imprint, will be received in national and local depositories, but must be withdrawn at the expense of the empire. * * * * *Mint law of July 9, 1873.*

MONETARY CONVENTION BETWEEN THE KING OF NORWAY AND SWEDEN AND THE
KING OF DENMARK, MAY 27, 1873.

ART. 10. * * * Subsidiary coin ceases to be legal tender of payment, relative to the state funds, when so worn as to be no longer capable of identification, in so far as regards the country by which it was issued, but relative to all other parties when the inscription shall have become disfigured, or when it shall have been rendered indistinct by abrasion.

All coin having ceased to be deemed legal tender of payment relative to private funds and parties shall be withheld from circulation after having been paid into any of the state funds. The same rule applies to silver coin which shall have been reduced over 4 per cent. below its standard weight. * * *

MONETARY SYSTEM OF THE NETHERLANDS.

* * * 6,7. There is no law requiring the withdrawal from circulation coin whose value is diminished by wear. However, the accounting clerks are authorized by a decree of the minister of finance to reserve coins which have been returned in so defaced a condition that they can no longer serve as a circulating-medium. These coins are replaced by new ones at the expense of the state. * * *

Mr. MAISH. What do you think about the propriety of coining these five-cent silver pieces?

Dr. LINDERMAN. I will refer to what I stated when last here. Under the act of 1865—I believe that is the date of the act, 1865 or 1866—the issue of a five-cent nickel coin was authorized for the first time in our coinage history. By another provision they were made redeemable in national currency. That was re-enacted in the coinage act of 1873. Being redeemable in national currency they are about the same as a gold coin. Altogether there has been six million dollars in nominal value coined. If you create a silver coin of the value of five cents that is not redeemable in standard currency, this inferior currency will force in all the nickel coin, and if driven in, as they must be, they must be disposed of as old metal. The proportions are as seventy-five to twenty-five. That is not a proportion which could be used in plating. We would not realize over a million from the sale of it probably. It might entail upon the Treasury a loss of about five millions of dollars. I think when you come down to a token coin the cheaper it is the better. It seems to me the five-cent nickel is quite as useful. I think that in respect to the abrasion it will be less than silver. The abrasion is much greater in small pieces than upon the larger ones, in both gold and silver. You see how these three-cent pieces are worn. The abrasion would be about three times as much as in the half-dollars. I think it would be well for the committee to take some steps in regard to the three-cent pieces to get them out of the way, especially those of the fineness of only seven hundred and fifty thousandths.

While we are having a large silver profit, the rate of wear and tear at which receivable in the Treasury ought to be established, so that a portion of the seigniorage derived by the government be applied to the reparation of our coins instead of being covered into the Treasury. It seems to me to be one of the soundest principles, that the government ought to keep these coins in a good state of repair. If you have a general section regulating this, the abraded coin will come in gradually and the loss from recoinage will be very small, and the effect will be to keep our coins in a good state of repair. I only refer to the coins which the government issues—those from which it realizes a seigniorage. Gold is so much more valuable as to quantity that it is liable to fraudulent reduction. That is all I wish to say, unless the committee wish to hear from me with reference to fixing the rate of abrasion upon which the coin shall be receivable at the mints for recoinage; say four or three

per cent. Either of these would do, but I should prefer the former. The Treasurer of the United States does not know what to do with them when they come to the Treasury. That officer has no profit and loss account, and he has to let them lie and have them charged up against him.

There is a matter which came to my attention this morning. The Secretary of the Treasury suggested that I bring it to the attention of the committee. In 1873, when the coinage act was adopted, there was a provision authorizing the coinage of trade-dollars for depositors. When first coined it was made a legal tender to the amount of \$5. When silver fell to fifty-three pence, the provision giving them a legal-tender quality and placing them on an equality with more valuable coin was repealed. We got that provision repealed, and the Secretary was authorized to limit the coinage to the demand for export. The difficulty is at San Francisco. There is from one to one and a half millions of these trade-dollars coined monthly, and the high price of greenbacks enables depositors to send part of their coin here, and put this coin in circulation that has no legal-tender quality in place of the half dollars on which the government has a seigniorage.

The dispatch received reads :

That the total of coinage of trade-dollars since July 1 has been five million three hundred and ninety-two thousand. All but two thousand actually issued. The foreign exports during the same period have been three millions six hundred and sixty-five thousand. Amount sent to Eastern States by express this month, eleven hundred and eighty-four thousand. Profit in shipping trades east at the present time, three per cent.

My purpose in calling your attention to this is this: that having this question of the remonetization of silver before you, to show you that this would be one of the evils of coining silver dollars for depositors while the present ratio between gold and silver prevails. Unless coined on government account, importers of bullion would realize this gain between the bullion value and the nominal value of the silver as a legal tender in the payment of debts. I am not arguing for or against the remonetization of silver, but simply desire to call this important measure to your attention. That is all I have to say to the committee.

Mr. MAISH. Do you receive much of the coin of the United States defaced with advertisements, &c. ?

Dr. LINDERMAN. There were some parties out in the Northwestern States who advertised their shoe-houses on one side of the coin. Their object in writing us seemed to be to get permission to use them without incurring a penalty. I believe a section has been submitted looking to the prevention of this. It ought to be passed, because it covers up the inscriptions.

Mr. MAISH. Is not the best way to prevent it to establish a penalty ?

Dr. LINDERMAN. I think so.

Mr. MAISH. Would it be advisable to make it valueless as well, when so defaced ?

Dr. LINDERMAN. The people never look at the coin if it has got the color.

Mr. MAISH. I wish to do both, provide the penalty and render the coin valueless when so defaced.

Dr. LINDERMAN. You can do both.

Mr. MAISH. If we only provide the penalty there would be no one to report it.

Dr. LINDERMAN. If permitted, part of the coin could be taken off and then covered up.

Mr. MAISH. What would you say as to its being received when thus defaced?

Dr. LINDERMAN. I should say that no one should be compelled to take it.

Mr. MAISH. And that the government would not redeem it?

Dr. LINDERMAN. If we took the advertisement off and found that it had not been tampered with, I suppose the government would have to redeem it.

Mr. MAISH. In addition to the penalty prescribed, you would be in favor of providing that no person would be compelled to receive it?

Dr. LINDERMAN. Yes, sir. I have prepared, by request of the chairman, as there is so much confusion in some of the pamphlets on the subject, a statement that will show the ratio of the different coinages and different rates in our silver coin. I have thought it would be more reliable for the use of the committee.

Value.	Ratio.	Dollar, grains.	Coining rate.
60 $\frac{1}{2}$ pence	1 to 15 $\frac{1}{2}$	399. 9	1. 20 $\frac{93}{100}$
59 pence	1 to 15 $\frac{93}{100}$	412 $\frac{1}{2}$	1. 16 $\frac{11}{100}$
Trade-dollar	1 to 16 $\frac{28}{100}$	420	1. 14 $\frac{28}{100}$
54 pence	1 to 17 $\frac{46}{100}$	450. 3+	1. 06 $\frac{54}{100}$
57 $\frac{1}{2}$ pence	1 to 16 $\frac{47}{100}$	424. 9+	1. 12 $\frac{95}{100}$

If we assume the price of the coinage to be what it was before 1870, and the two metals to be in the ratio recognized under our system, if the value of the silver be fifty-nine pence, the coining-rate of our dollar of four hundred and twelve and one-half grains would be one dollar and sixteen and four-elevenths cents. As a general proposition, it may be said, except as to increased production, whatever tends to depreciate the one tends to appreciate the other.

Mr. DWIGHT. At the present price of silver how many grains would it take to make our dollar of gold value?

Dr. LINDERMAN. Four hundred and fifty and three-tenths plus grains.

Dr. HUBBELL (to Mr. Eckfeldt). Was that metal of these first coins treated with sulphuric acid?

Mr. ECKFELDT. The first were annealed and cleaned in the same manner that all gold and silver coins are annealed in the mints. We did not depart from the system. They were cleaned, after heating and annealing, with a weak solution of sulphuric acid, which removes the film of the oxide of copper.

The second lot were sealed up in a can so that the air could not come in contact with them. And then they were heated and afterwards cooled without opening the can. They came out the same color they had when put in. The cleaning with vinegar, whiting, and buckskin made no impression upon them. I followed Dr. Hubbell's directions implicitly.

[There are some "goloid" and some silver coins shown to Mr. Eckfeldt—two pieces of goloid, two pieces of the trade-dollar—and he is asked upon which has been put the muriatic acid.]

Mr. ECKFELDT. In cleaning the planchets, before striking both the silver and the first piece of goloid, they were cleaned with a weak solution of sulphuric acid. It gives a lively color and appearance to the coin. A weak solution of acid removes the oxide of copper, and leaves a pure silvery appearance. It leaves an exceedingly thin film of pure silver on the surface of the coin, and a little wear will give it the

true color of a standard coin of nine-tenths fineness. Then the muriatic acid will have no more effect than upon this metal. We do not consider muriatic acid to be a test of gold or "goloid." Specific gravity is not a test except by an expert.

Dr. LINDERMAN. The bill to establish the metrical dollar—I would like to say a word about that. I know very well the gentleman who is urging it; he is a very clever gentleman. I observe that his plan will reduce the value of the present gold dollar, I think, three-tenths of one per cent.

I think you should ask the gentleman who is urging this change to give you a formula for reducing pounds sterling, francs, and the German mark into our money.

Mr. MAISH. He has been asked to do it.

Dr. LINDERMAN. Another thing: Under the act of the 4th of March, 1873, the values of foreign coins are converted into our standard by comparison of the pure gold in those coins. That comparison is made with our present unit of value in our own country. This will alter that unit, and will alter it in all other countries comparatively.

The CHAIRMAN. How would it do to say the alloy in our dollar is one-tenth and the dollar shall have one and one-half grains of pure gold?

Dr. LINDERMAN. Everybody knows that our gold and silver coins are nine-tenths fine; whether reduced in weight or not, nine-tenths of the actual weight is pure metal. This is the simplest of all systems. It is not strictly according to my view a metrical coin. You take a grain and a half, if I understand it rightly. The five-cent nickel piece is of the weight of five grains, yet I think that few persons outside of the committee know what it weighs. When you alloy this quantity of fine gold it becomes necessary to make a new term which has never been used in connection with the metric system proper, called a tergram. That would make a strange sort of a metrical dollar. It seems to me that as this would take us into indefinite fractions, there is nothing to be gained by this proposed change to make the dollar one and one-half grains of pure gold. It is, when alloyed, one-tenth copper and the balance pure gold.

The CHAIRMAN. I would like to have you prepare a bill covering this subject, if you can do it.

Dr. LINDERMAN. I will try.

The following papers were presented and ordered on the minutes:

GOLOID COIN.

Memorial from William Wheeler Hubbell, in relation to goloid coin.

The goloid dollar, troy, weighs only 258 grains; the half-dollar, 129 grains; the quarter, 64.5 grains. Forty per centum of its intrinsic value is gold; sixty per centum of its intrinsic value is silver. Its standard of fineness is .9, being the same fineness and relative weight as the present troy gold and silver coin of the United States; and by its weight and fineness of the precious metals it is, like all other coin, current in foreign countries. The size of the dollar will be about the same as the present silver half-dollar, and the fractions in proportion. The gold is rated as one to sixteen of silver in relative value. Two gold dollars and three silver dollars will make five goloid dollars equal in weight and fineness, allowing 412.8 grains for the silver dollar.

Goloid is "gold and silver coin" metal, fully within the letter and spirit of the Constitution, and is of the same standard value both in fineness and weight as, and the exact equivalent of, the gold dollar and silver dollar of the United States, in which its obligations are payable, they being payable in coin, or equivalent, of the same standard value then authorized by law.

The density of goloid is .117 greater than the mean of its constituents, which are one pound of pure gold, twenty-four pounds of pure silver, two and three-quarter pounds of pure copper fused and combined, and may be slightly varied within the patent. It forms a new metal, similar in color to platina, and of a close, dense touch and appearance; is non-corrosive, polishes by use, does not oxidize or waste, and is very durable for coin—more durable than either gold or silver. In any one payment, as it tenders forty per cent. in gold and sixty per cent. in silver, this alone tends to keep the two metals of standard gold and of silver at par or eqnal, for being metallurgically bound together as a *unit of value*, they become incapable of speculative array or short sales against each other *pro tanto*.

Goloid also itself compensates for any variation either way between them in pure or in standard bullion, and maintains itself near or above par, or 100, by its intrinsic worth, and the fact that the speculator cannot separate its elements to sell one short as against the other, as he can between gold coin and silver coin; hence if he sells short he cannot fill his contract, and the two metals will naturally keep at par, or equal.

Illustrations: If gold is 110 and silver is 95, and legal-tender notes 100: Therefore, $110 \times 40 = 44.00$; $95 \times 60 = 57.00$; $57 + 44 = 101$; thus the goloid dollar would be one per cent. above par, or 100, in legal-tender notes, and the notes interchangeable with it would stand at full par. If silver is 98 and gold 103: $98 \times 60 = 58.80$; $103 \times 40 = 41.20$; $58.80 + 41.20 = 100$; the goloid dollar would be at par, or 100, precisely, in lawful notes.

Suppose the market or speculative values of the silver and gold as bullion were reversed, and silver, as formerly, be the most valuable, goloid has the same substantial effect.

If silver is 103 and gold 100, as they once were: $103 \times 60 = 61.80$; $100 \times 40 = 40.00$; $61.80 + 40.00 = 101.8$, the goloid would stand at 101.8 in intrinsic worth. It is the only precious metal certain to maintain paper redeemable in it nearest to a par, or 100 standard, under all the speculative or market fluctuations that may take place in the pure bullion value of the precious metals, by its internal principle of self-compensation; and also by its fixed unity of the precions metals it tends to prevent speculation and fluctuation by preventing the separation necessary to sell one short as against the other.

And in the advancement of science and civilization requiring its use, as a basis of coin value, it is the only precious metal ever discovered, suited for coin, which is not too soft, will not oxidize, is of increased density and durability, and impossible to connterfeit in weight, appearance, sense of touch, and size, by any other metals. Its unit of value of the two precious metals, its smaller, convenient size, increased density, non-corrosive durability, non-liability to destruction for jewelry, gold-leaf, or silver-wares, and its monetization of both metals about in proportion as produced from the mines here, make it especially useful as coin-metal to the United States for its commercial use in dollars, halves, and quarters only.

At present, the gold and silver coin fail of their legitimate purpose, largely because they are destroyed for manufactures, for which bullion alone should be used. Goloid coin cannot be readily used for gold jewelry or gold-leaf nor for silver ware; it is not suited for the former, and too valuable for the latter—facts of great importance in its favor to prevent its destruction, and keep it in circulation for legitimate purposes and uses as commercial coin.

With it in use, as troy-weight coin, the coinage of the United States will stand as follows in denomination and troy weight, as at present:

Gold double-eagles,	\$20	= 516	grains .9 fine.
Gold eagles,	\$10	= 258	grains .9 fine.
Gold half-eagles,	\$5	= 129	grains .9 fine.
Goloid dollars,	\$1	= 258	grains .9 fine.
Goloid half-dollars,	.50	= 129	grains .9 fine.
Goloid quarter-dollars,	.25	= 64.5	grains .9 fine.
Silver trade-dollars, for export,	\$1	= 420	grains .9 fine.
Silver dime,	.10		token .9 fine.
Nickel,	.05		token.
Copper cent,	.01		token.

These are all the denominations and kinds of coin necessary for commercial and domestic purposes.

Goloid is also precisely suited to the metric system of coinage.

The old, large, and heavy silver dollar of 412.5 grains, which is 154.5 grains heavier than the goloid troy dollars, and the subsidiary halves and quarters of less, or token, value, causing great loss on retail sales under five dollars, and which are continually oxidizing and wasting away at great loss to the government and the people, can be remelted, and made into goloid coin of greater utility and greater and more stable commercial value and use, as becomes the United States of America, which, by natural right, in the gift of these metals in our mountains and advance in science, has the just right to take this lead in monetary supremacy, for its internal and external commercial uses, and to repurchase and pay off or reduce its national debt now held in foreign hands, by increased production, and not by depleting taxation, shrinkage, and oppression.

Calculations in troy coin weight.

Two gold dollars, 25.8 grains each .9 fine= 51.6 grains.
 Three silver dollars, 412.8 grains each .9 fine=1238.4 grains.

Goloid dollars, 5)1290

grains each, 258

$25.8 \times 16 = 412.8$ grains.

One pound of pure gold= 5,760 grains.

24 pounds of pure silver=138,240 grains.

2.75 pounds of copper= 15,840

$258)159,840(619.5$ dollars.

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1 gold.	1
24 silver.	<hr/> 138
2.75 copper.	<hr/> $\frac{1}{2} = 129$
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2.77	7
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.02—infinitesimal, less, to insure fineness of .9, and allow for oxide and floss cinnabar waste in the silver, which seems to be displaced.

The goloid dollar is therefore of full intrinsic value in fineness and weight, and even of metric weight, or $16\frac{2}{3}$ grams, it is about five per cent. more valuable than the old silver dollar of 412.5 grains, which could not be reduced to the metric system without still further loss in value. Handling or use gives it a polish and does not oxidize and blacken it, as it does with silver coin.

Even at present speculative values, with silver at 92 and gold at 103— $92 \times .60 = 55.20$; $103 \times .40 = 41.20$; $55.20 + 41.20 = 96.40$ —the goloid dollar would be 96.4 in gold; and the fact of its use of silver with the gold would bring the silver up and gold down to about par, and the goloid dollar would be fully up to par, or 100, in notes, gold, or silver. It would

compel them all to stand at par, and that, too, without any contraction of the volume of sovereign or legal-tender money. Its volume can expand with population and civilization and business, and its power of compensation and prevention of speculation in its elements will steadily hold all constant, or at par, 100.

With goloid coin at par and in abundance, we can, through the bounteous gift of nature in gold and silver and copper, repurchase our foreign-held bonds, and cease to toil and slave to pay tribute abroad, on a debt for which we receive only imported goods, sold to us at gold prices, with gold ranging from 150 to 240, and for which we never receive the actual value that we are now bound to pay for it in coin at or near par. But with peace, union, and the prosperity induced by this goloid coin, our exports of staple products will fully pay for our increase of imports incident to a return of prosperity, and all home industries awakened into activity will find increased ready home consumption for their manufacturers.

WM. WHEELER HUBBELL,
Counselor, Inventor, and Patentee.

WASHINGTON, D. C., November 19, 1877.

UNITED STATES PATENT OFFICE.

William Wheeler Hubbell, of Philadelphia, Pa. Improvement in metal alloys for commercial coin.

Specification forming part of letters patent No. 191146, dated May 22, 1877; application filed April 4, 1876.

To all whom it may concern:

Be it known that I, William Wheeler Hubbell, of Philadelphia, Pa., have invented a new and useful metal alloy for commercial coin, and the following is a description thereof:

The invention consists in the discovery and manufacture of a denser, more valuable, or heavier alloy for a given size, adapted to coin-dollars, and more difficult to counterfeit; and consists of certain proportions of gold, silver, and copper. The exact and best proportions are one pound of gold, twenty-four pounds of silver, and two and one-half pounds of copper. Melt them separately and pour them together, and, in mixing, add one grain of sulphate of sodium or sulphate of potassium to one thousand grains of the metal. The alloy metal is slightly heavier than the mean of the component metals, which makes it peculiarly valuable for coin, not easily counterfeited. At the same time, a dollar of the alloy is very much less in size than a silver dollar. The proportions may be slightly varied. The silver may be increased to thirty parts to one of gold, and decreased to twenty parts to one of gold. The copper may be increased to one-eighth and decreased to one-twelfth. But the most perfect or maximum affinity is established in the proportions of one of gold, twenty-four of silver, and two and a half of copper.

The alloy metal free from flaws shows a density 10.802, and with flaws 10.710. The mean density of the several metals is 10.685, and the alloy metal shows an increase in value or weight or density of .025 to .117. Usually gold and silver alloyed are less in density than the mean of their constituents.

This alloy of gold, silver, and copper, within these proportions specified, owing to its great destiny and intrinsic value, is especially valuable or suited for coin-dollars and fractions of a dollar.

I claim as my invention—

The alloy coin metal of gold, silver, and copper, substantially in the proportions and for the purpose described.

WM. WHEELER HUBBELL.

Witnesses:

THOMAS C. CONNOLY.

A. E. BEECHER.

Calculation on bill H. R. 907, to adapt the goloid metal to the system of coinage stated in this bill, and to the metric system.

Standard gold :

One dollar = $1\frac{2}{3}$ grams as prescribed = .9 fine by the bill 907.

Double-eagle = $20 \times 1\frac{2}{3} = 33\frac{1}{3}$ grams = .9 fine.

Eagle = $10 \times 1\frac{2}{3} = 16\frac{2}{3}$ grams = .9 fine.

Half-eagle = $5 \times 1\frac{2}{3} = 8\frac{1}{3}$ grams = .9 fine.

Standard goloid coin :

$1 = 16$ as $1\frac{2}{3} = 26\frac{2}{3}$ grams.

$1\frac{2}{3} \times 2 = 3\frac{1}{3}, 26\frac{2}{3} \times 3 = 80$

$80 + 3\frac{1}{3} = 83\frac{1}{3}$.

$5)83\frac{1}{3}$

$16\frac{2}{3}$ grams = one goloid dollar = 257.2 grains.

One goloid dollar = $16\frac{2}{3}$ grams = .9 fine.

Half goloid dollar = $8\frac{1}{3}$ grams = .9 fine.

Quarter goloid dollar = $4\frac{1}{6}$ grams = .9 fine.

Being the same weight as the eagle, half and quarter eagle, respectively, under this bill 907.

The bill 907, on which the statement of November 19, 1877, is made by request, is on a system of tergrams, advanced by the American Statistical Association in 1868, on the basis of 1.5 fine gold and $1\frac{2}{3}$ grams standard .9 fine. The 1.5 is in accord with the metrical system, which is a decimal system; but the $1\frac{2}{3}$ or ternary division is not in accord with the metric or decimal system, and cannot be made in accord, as it would always leave a third fraction over. Hence a ternary or tergram is incompatible with the principle of the metric system as recognized in the Revised Statutes and in Europe. "Systems having for their basis the decagram of gold of nine-tenths fineness, which unit has been advocated by Chevalier, Dr. Farr, and other European political economist" (see report of Dr. Farr to the International Statistical Congress, held at the Hague in 1869), are preferred as stated.

As a lawyer and scientist, and as a legislator, I should prefer to adhere to this essential basis, expressed in grams and its decimal divisions, because the coin as issued and weighed contains the one-tenth of alloy, and are nine-tenths fine as issued by the United States, and because the denominational divisions of coin as originally issued by the United States have been on the decimal or metric principle; and further, and chiefly, because the metric system is a decimal system exclusively, in all its applications of weights and measures, and should be so

in coinage, and not ternary. The ternary division of grams into tergrams does not give the closest approximation of weight to the present United States coinage weight. It does afford brevity of expression; but that is so seldom stated in words as to be of no importance, compared with the diminution of weight and value, or intrinsic worth of the coin reduced to tergrams.

The present weight of gold coin of eagles, double-eagles, and half-eagles may be maintained, and be expressed in metric measure within the deviation of each coin now allowed by law, and within 80 cents in a thousand dollars, only, less than the actual present weight. Thus:

Weight for the double-eagle of 516 grains troy = thirty-three grams and four hundred and thirty-six milligrams, stamped thus:

33.436+
grams
gold .9 fine.

The eagle = sixteen grams and seven hundred and eighteen milligrams, thus :

16.718+
grams
gold .9 fine.

The half-eagle = eight grams and three hundred and fifty-nine milligrams :

8.359+
grams
gold .9 fine.

Goloid dollar = 16.718
grams
1 G. 24 S. .9 fine.

Goloid half-dollar = 8.359
grams 1 G. 24 S. .9 fine.

Goloid quarter-dollar = 4.1795
grams.
1 G. 24 S. .9 fine.

The United States having originally established its coinage on the decimal or metric system as to its divisions or relative denominations with the dollar of 100 cents as the unit of value, can now readily thus adopt the metric system of weight in decimals instead of the troy divisions, without disturbing the metric values and divisions heretofore made, by adopting the system of gold stamp, and coinage of goloid before expressed.

Table of metric goloid dollars, 900 fine.

No. 1. Coined-gold, .036 parts; silver, .864 parts; copper, .100 parts; weight, 16.718 milligrams, or 258 grains value = 100 cents in gold.

No. 2. Gold, 6 decagrams; silver, 147 decagrams; copper, 17 decagrams; total weight, 17 grammes; value, 100.94.

No. 3. Gold, 6.5 decagrams; silver, 146.5 decagrams; copper, 17 decagrams; total weight, 17 grammes; value, 102.19.

No. 4. Gold, 7 decagrams; silver, 137 decagrams; copper, 16 decagrams; total weight, 16 grammes; value, 103.43.

No. 5. Gold, 8 decagrams; silver, 136 decagrams; copper, 16 decagrams; total weight, 16 grammes; value, 109.65.

Silver 59 pence per onnce, sterling; gold 100 in the estimate.

The metric dollar No. 1, coined is the exact equivalent of the 25.8 grain gold dollar, and the 412.5 grain silver dollar of the United States, as 40 cents of the former is to 60 cents of the latter, and is 16.718 milligrams or

258 grains in weight. Rating silver lower brings the others, Nos. 2, 3, 4, 5, down to par, or 100 in gold, thus:

	Cents.
Silver at 58 pence, No. 2, is worth, in gold.....	99.93
Silver at 58 pence, No. 3, is worth, in gold.....	101.17
Silver at 58 pence, No. 4, is worth, in gold.....	102.41
Silver at 58 pence, No. 5, is worth, in gold.....	108.63
Silver at 57 pence, No. 2, is worth, in gold.....	98.91
Silver at 57 pence, No. 3, is worth, in gold.....	100.15
Silver at 57 pence, No. 4, is worth, in gold.....	101.39
Silver at 57 pence, No. 5, is worth, in gold.....	107.61
Silver at 56 pence, No. 2, is worth, in gold.....	97.89
Silver at 56 pence, No. 3, is worth, in gold.....	99.13
Silver at 56 pence, No. 4, is worth, in gold.....	100.37
Silver at 56 pence, No. 5, is worth, in gold.....	106.59
Silver at 55 pence, No. 2, is worth, in gold.....	96.87
Silver at 55 pence, No. 3, is worth, in gold.....	98.11
Silver at 55 pence, No. 4, is worth, in gold.....	99.35
Silver at 55 pence, No. 5, is worth, in gold.....	105.57
Silver at 54 pence, No. 2, is worth, in gold.....	95.85
Silver at 54 pence, No. 3, is worth, in gold.....	97.9
Silver at 54 pence, No. 4, is worth, in gold.....	98.33
Silver at 54 pence, No. 5, is worth, in gold.....	104.56
Silver at 50 pence, No. 5, is worth, in gold.....	100.48

Metric gold coins in grams: Double eagle, gold, 30 grams; silver, 2 grams; copper, 1 gram; total weight, 33 grams. Value, \$20.

The value of No. 1 in gold is fully stated in the estimate furnished by the Director of the Mint. With silver at 56 pence only, No. 4 of 16 even grams in weight, dividing into even 8 grams for halves, and 4 grams for quarters, is above par in gold, or rather gold falls below par of 100 in goloid. Goloid is in reality the most constant standard of value to 100 as par.

WM. WHEELER HUBBELL,
Inventor.

Advantages of the goloid coin in dollars, halves, quarters, and dimes. Gold in half-eagles, eagles, and double-eagles. By Wm. Wheeler Hubbell, esq.

1. The goloid is in reality a gold dollar, about one carat fine, monetizing silver on a basis of 16 to 1, and 40 per cent. of gold to 60 per cent. of silver, forming the precious metals into an absolute unit of value, without conflict or expulsion of either. This is the dollar in the Treasury estimate of values, containing .036 gold.

2. It forms coin of convenient size, weight, and extreme durability; the noblest metal, gold, forming a protection to the silver and alloy of copper against the outer oxidizing influences to which the coin is exposed by use. The noblest metal, gold, always asserts itself in supremacy, by the laws of self-compensation. This causes the coin to assume the purple-golden tint by use, and become far more cleanly and durable than the secondary noble metal, silver. The coin first struck at the mint are admitted by the mint officers to have been silver faced by their sulphuric acid bath, used for silver coin, but not on the second striking.

3. The Constitution of the United States, as if by inspiration, contemplated the use of "gold and silver" for coinage conjunctively. It did not contemplate them disjunctively; not gold or silver, but both in

harmony, and it gave no power to demonetize either of them. The power to coin was vested in the United States exclusively, and denied to the States; hence, not being a concurrent right in the States, it became the duty of the United States to execute it.

The goloid coin is embodying, by science, invention, and advancement of civilization, what the Constitution contemplates in fact; that is, the coinage of gold *and* silver in conjunctive unity of value in some way. The right to declare "gold and silver coin" a legal tender is allowed to each State in its sovereign capacity within its own jurisdiction. Any declaration by Congress, therefore, as to legal-tender power in coinage must be permissive, and not prohibitory, in form.

The goloid coin is "gold and silver" coin, with the usual one-tenth alloy of copper to make it metallurgically available for coinage; its value, or quantity and proportions, Congress has the power to regulate under its power to "regulate the value thereof." It is, therefore, a coin which the advancement of science and requirements of our internal productive industries have developed by invention fully up to the declarations of the Constitution of the United States.

4. It is gold and silver coin of the United States when authorized by Congress in exact and full equivalent of the 25.8-grain gold dollar, or gold coin, which is 21.6 carats fine, or .9 fine, and the 412.5-grain silver dollar .9 fine, as 40 of the gold dollar is to 60 of the silver dollar, making 100, gold and silver standard, of copper alloy to harmonize its elements, and form "goloid," a convenient name to signify containing gold.

Without any possible imputation, therefore, of selection or unfairness of discrimination, under the joint declaration of Congress, or obligation to pay the debts or bonds of the United States in "coin of the United States of the standard value of 1870, or its equivalent," it is both and all coin of the same standard value, and also a full equivalent, as bullion alone, in the most comprehensive and fullest meaning of the obligation, both in jointure and severalty of application to the precious metals, and also to the doctrine of full equivalents.

It also is a coin or right of coinage, incident to the exercise of sovereignty exclusively as to coinage, vested by the Constitution in the United States, which is a distinct right, to be exercised in general, separate and distinct from any prior obligation to pay in any particular form or manner at a future date; and the exercise of which is to be directed by the present and prospective interests and requirements of the people of the United States.

5. Experience of ages of the world has proved that the two metals, gold and silver, coined separately, drive each other out of circulation, as they vary in speculative value in the commercial marts of the world; the lesser in value always displacing the greater in value, as men will pay in that of the least value, and sell that of the greatest value.

Gold, if below par of 100, will expel silver if at 100; and silver, if below par of 100, will expel gold if at 100. Neither metal, as between themselves only, can ever be said to be above par or 100. Neither metal can be said to be a standard of value to the exclusion of the other. Some of the great nations of the earth make silver alone the standard of value, others make gold alone the standard, some strive to make both standards in separate coinage. Some, therefore, expel one metal voluntarily, others have one to expel the other by the duality of coinage.

Science, guided by the great laws of nature in its chemistry and electro-affinities, seizes the three elements, gold, silver, and copper, forms them into a ternary metal, goloid, a full unit of value of all, per-

fect in its atoms, and, as a whole, a metal of superb uniformity of quantities and value, and working into coin of superior finish, color, and quality. The natural color is purple-golden, and wears with an outer golden hue, the noblest and most indestructible metal (gold) naturally asserting its superior resisting powers in the atoms, and arresting the oxidizing effects of use and air by its resultant law of self-interposition. On the same principles, also, at first I may strike the coin with a face of gold about five or six carats fine and about one one-hundred-thousandth part of an inch thick, as an integral part of the coin-metal. The capability of attenuation of gold is proved to be over the one two-hundred-thousandth part of an inch and exhibit color. (Page 434, Johnson's Universal Cyclopedic of Useful Knowledge, vol. iii; pages 593 and 594, vol. ii.) As to the color of the coin at first, it depends upon the manner of treating the metal after it has been rolled into strips of the requisite thickness. My directions in this respect are not followed as I intended. At first the strips were annealed in the air in a furnace and placed in sulphuric acid, which removed the oxide of copper, bleached the silver. As the acid took to the copper, the sulphur took to the silver, for which silver has a great affinity. This practically faced the goloid with silver, and a silver coin being treated in the same way, they on the surface necessarily looked much alike; to which silver face Dr. Linderman objected, and so do I, as the natural face is for the superior metal, gold, in resisting power. On the second striking, without any special directions from me, the planchets were cut from the strips and inclosed air-tight to be annealed. This, of course, prevented oxidization and preserved the metal clean, so that my cleaning process could not more than clean that which was already clean; and thus the coin was struck, showing the natural purple-golden hue, reflecting both the purple and the rose tints which gold, silver, and copper combined will alone produce. The attempt to at first show the gold face, made by Mr. Eckfeldt, it appears, failed because the metal was passed too soon from the muriatic acid bath to the ammonia before the acid acted at all. I have produced the gold face at first since on the same plate of metal. The most expeditious and practical way is to put the strips in the annealing furnace, as usual, and, instead of putting them in sulphuric acid, put them in muriatic acid, take them out, and lay them in the open air in a room until the acid has taken effect on them, aided by the air, about four hours; then put them in the ammonia, clean them off as directed, and they will have a purple-golden face of an orange hue; cut into planchets and strike into coin. I can show a workman in person how to do it. A darker hue is obtained by vinegar and salt.

6. God, in his wonderful providence in the arrangement of matter, has given the United States all the natural elements of prosperity. If it will only be wise and use them, and not deny them a true position, all will be well. We have the greatest mines in the world of all the precious metals needed as the sovereign money basis, of unparalleled prosperity, induced by productive industry.

All that the people need is an abundance of gold and silver coin, interchangeable with about \$400,000,000 of sovereign money notes—about \$800,000,000 in all of sovereign money, \$20 to each per capita, as an assured basis of representative valuation for interchange and the fulfillment of contracts, on a steady basis of valuations—and industry and enterprise, now crushed to the dust and weeping in ashes and desolation, will, revived by hope and assured support, spring into activity

and rise with resistless power into matchless prosperity and progress among the nations of the earth.

7. The Director of the Mint asserts, what is undeniable, that at present the capacity of the mints to coin the goloid metal is fully equal to \$6,000,000 or \$8,000,000 per month, or \$72,000,000 to \$96,000,000 a year; while of silver coin alone it is only \$36,000,000 a year; a difference in favor of goloid of \$36,000,000 to \$60,000,000 alone.

This could be readily increased to \$100,000,000 and \$120,000,000 a year by slight additions.

While to coin that much silver coin would require the building of mints, the expenditure of hundreds of thousands of dollars, and many months, yes perhaps years, of time to erect them. While the country is perishing for want of the money, and when silver is obtained it drives gold out, itself is exported to China and elsewhere, is destroyed in the arts, and turned away thereby from its legitimate channel and duty of coined money as a sovereign basis or medium of exchange in conducting the industrial and commercial prosperity of the people. That is the only legitimate function of coined money. To destroy the coin is against public policy and a perversion of its purpose.

Gold bullion and silver bullion alone should be used for jewelry, silverware, and in the arts; not the coin.

Goloid coin has a tendency to prevent this ruinous destruction, to itself assert its legitimate position as coin for the purposes and uses of money, and to compel the arts not to encroach on the monetary rights of industry, by using the easy alternative of ingots of bullion for manufactures. [England makes it a penal offense to destroy coin.]

8. I do not assert for goloid a natural right to the entire field of coinage. My views as to the equitable and well-balanced distribution of coinage are expressed in the bill No. 2698, which I prepared to exhibit in a concise legal form, as an entire system, the subject of coinage, from the cent to the double-eagle of gold, and the expression of the practical unit of the metric system, the "milligram," and which the Director informs me is used in practice in weighing in the mint. Thus, I think, proving that, in arriving at its determination by computation, and the usual rules in invention, it must be the true basis or *unit* for coinage within the metric system.

In the arrangement of coinage of the silver dollar, which may be preferred at present in some parts of the country and for export to China, and the goloid coin and gold coin, the goloid holds the controlling power of monetary forces, and tends to hold all at or very near to par, 100. (See Treasury estimates of January 14, 1878.)

Its compensating power in this respect is beyond the speculative influence of the bulls and bears of the money market, as they cannot deliver on short sales; they dare not contract, either to sell or to buy, except in *bona-fide* transactions, which alone are legitimate.

The gold now in the Treasury, instead of going into the hands of speculators on January 1, 1879, will, \$40,000,000 of it, go into \$100,000,000 of goloid coin, and this coin will itself hold the balance of power; otherwise gold might, after January 1, 1879, be withdrawn from the Treasury for legal-tender notes, gold go up to about 120 to 150 in legal-tenders, the surplus go to Europe, and we be in precisely the same condition we were in before the Treasury accumulated the gold; that is, without the gold—yea, worse, without lawful money.

Our bonded debt of \$1,000,000,000, or thereabouts, held abroad against us by single gold-standard countries, is the balance of power in interest and principal both, and the only sure counterbalance of monetary power

that we are able to interpose to offset this is goloid, and our mountains of silver, gold, and copper to produce it, aided in the start with our ability at present to coin within one year about \$100,000,000 of this high intrinsic standard coin. With some coinage of silver and of gold, and the gold on hand, we can produce and have in one year about \$200,000,000 of the best coin in the world, which, with \$400,000,000 of legal-tender notes interconvertible with it, will give us \$600,000,000 of sovereign money of the most substantial kind for industrial prosperity.

Bank-notes are not money, as they are not a full legal tender in commercial business among men, and not safe, because of their surrenderability, as the basis of continued valuations in contracts or industrial enterprises. The banks can supplement this sovereign currency to suit localities. If the entire money basis of notes was sovereign, it would be better for the people at large.

The goloid coin stands independent as a money of intrinsic value, fully shown by the Treasury or Mint estimate submitted of date January 14, 1878, and with this for redemption and interchange, any system of notes may be maintained at a par commercial valuation, 100.

If the goloid coin goes abroad, it can only be when we have received full value for it. Its doré silver commands a premium in London, about one-half to three-fourth pence per ounce, fully sufficient to pay for its assay; but it does not follow that it will be assayed, nor is it material to us. We will have received its full value, as if transported as separate coin. Rather than assay it, the nations of Europe may adopt it as a solution of their difficulties, or submit to our impetus of prosperity derived from it, giving us great commercial advantages with China, South America, and other nations. In any event, nature has given us the mountains of these precious metals, they are her twin children, found often together, and converted by science into "goloid," we can buy back our foreign-held bonds, pay the taxes with one hand, and receive it in interest on them with the other, make them the foundation of credit among ourselves, and thus with good coin and note money, and abundance of it, rapidly advance in all the elements of peace and industrial prosperity.

As to counterfeiting. It is a weak reason to suppose that the counterfeiters for a profit of thirty-three per cent. on capital invested should obstruct the people in their possession of honest money. Imprisonment for ten to twenty years should be their position; not one of prevention or interference with the public welfare. There is not as much profit in thirty-three per cent. as there is in legitimate business or in counterfeiting the present silver and gold coin, where there is perhaps eighty per cent. profit. At all events, the natural color, ring, and weight distinguish the goloid coin, the touch also; and although gold does not distinctively color the inner mass of metal, yet gold always shows itself on the surface and near the surface, because other metals, silver and copper, in their atoms disappear and leave the gold indestructible at and near the surface.

This fact also makes the goloid coin, properly finished up, resist acids, which readily discolor silver coin.

The clear, prolonged ring; the clean touch; the purple, golden-rosy color; the weight; the perfection of finish; the resistance to muriatic acid; the presentation of a gold surface under the combined action of air and acid, are all peculiarities to distinguish goloid coin. And other tests will no doubt be found, such as the gauged scales now used to detect counterfeit coin. The goloid coin wears bright, clean, and more and

more golden-purple. Silver and all the baser metals wear darker and darker, or blacken as they oxidize by use.

Respectfully,

WM. WHEELER HUBBELL.

Hon. ALEXANDER H. STEPHENS,

Chairman Committee on Coinage.

WASHINGTON, D. C., January 26, 1878.

SIR : I have received and tested one of the goloid dollars made at the Philadelphia mint. It weighed when received by me 16.800 milligrams. Its true weight should be 16.718 milligrams, being 82 milligrams allowance overweight. The metal had the ring of goloid—dense, clear, and prolonged—but the color was much lighter than the goloid of my own make, and did not stand the same test of muriatic acid. The surface of the coin appeared to have been bleached to a silver hue or color, and to have been impregnated with sulphur, which caused it to turn to a jet black when the goloid test of muriatic acid was applied by me to it. The goloid metal is of a purple-golden color, and resists muriatic acid. I have removed this white, sulphurized, silver face from the coin partially, and disclosed goloid metal beneath, purple in color, and of the true metal. From the best information I can obtain of the treatment of the goloid at the mint after it was rolled into strips, and the appearance of the milled edge of the coin, and the resistance of the milled edge to my goloid tests, the strips of goloid were, or it was, pickled in sulphuric acid, which is also used for the strips of silver coinage. This pickling was without my knowledge or direction. Sulphuric acid will bleach the metal of its true purple color on the face, and cause it to absorb sulphur; which accounts for its silver-like appearance and ready destruction and blackening in color by my test of goloid, which is muriatic acid. I do not approve of this sulphuric-acid process even for silver, as it makes it destructible and easily turned dark by use by the people, easily counterfeited, and yields in black to the goloid test. I know the bleaching of the metal to a silver appearance was done with strips, and afterwards the circular form was cut, as the milled edges resist the acid. Since then I furnished the Director of the Mint with a formula of process of treatment of the metal in the strip, to avoid the use of sulphuric acid entirely, and work the metal so as to retain its true natural color on the face of the coin when struck, which accompanied the order of the committee to strike eleven more pieces of coin of the goloid metal under my directions.

Respectfully,

WILLIAM WHEELER HUBBELL.

Hon. ALEXANDER H. STEPHENS,

Chairman of the Committee on Coinage,

Weights, and Measures.

WASHINGTON, D. C., January 28, 1878.

SIR : I received one of the new striking of goloid dollars. It is much better than the first striking. It exhibits the purple-golden tint and reflection I said was the color of the body of the goloid metal. It is caused by the combined copper, gold, and silver. No two of them will give this

color, and no one of them will give this color. The silver facing which I discovered on the first issue or striking was admitted by the officer in charge to have been produced by the use of diluted sulphuric acid at the mint, being a process they use in silver coinage and in gold coinage. Dr. Linderman's objection to this silver finish, therefore, falls. It (the silver facing) was not authorized by me. I also return the plate of goloid metal for the inspection of the committee, the same produced by Mr. Eckfeldt, and on which they failed, through a misapprehension of the application of my written formula, to produce the gold facing which I said I could produce. I return it with the gold facing formed on it out of the metal itself, by the formula manipulated by myself. I could easily show how it is done.

With it the coin would at first have a gold face about six carats fine. The coin itself, on similar principles, to some extent, tends to form up a gold facing, in the natural decomposition of the facing particles of copper and silver in use and handling, until the gold finally protects them from external oxidizing influences by its greater resisting nature.

Respectfully,

WM. WHEELER HUBBELL.

Hon. ALEXANDER H. STEPHENS,
Chairman Committee on Coinage.

HOUSE OF REPRESENTATIVES,
Washington, D. C., January 14, 1878.

DEAR SIR: At a meeting of the Committee on Coinage, Weights, and Measures, of this date, the following resolution was unanimously adopted:

Resolved, That Dr. Linderman, Director of the Mint, be requested by the chairman to appear before the committee, at their next meeting, to furnish them information on the subject of coinage.

In compliance with the foregoing resolution, I would respectfully ask you to appear before the committee on Thursday the 17th instant, at 10.30 o'clock a. m.

Very respectfully,

ALEXANDER H. STEPHENS,
Chairman.

Dr. H. R. LINDERMAN,
Director of the Mint, 510 I street, Washington, D. C.

HOUSE OF REPRESENTATIVES,
Washington, D. C., January 21, 1878.

SIR: At a meeting of the Committee on Coinage, Weights, and Measures, held this day, the following resolution was adopted, viz:

That the Director of the Mint be, and he is hereby, requested to furnish the committee eleven specimen coins of the goloid dollar, without the alloy dressing of metal placed upon the face of the coin, but prepared and cleaned under the directions of Dr. Hubbell.

You are further requested to appear before the committee at 10 o'clock a. m., Saturday, 26th instant, in furtherance of the subject-matter discussed Thursday last.

Very respectfully,

C. H. CULVER, Clerk.

Dr. H. R. LINDERMAN,
Director of the Mint.

WASHINGTON, D. C., January 21, 1878.

Formula for goloid.

Proportions—	
Silver, pure.....	.864
Gold, pure.....	.036
Copper, pure100
	—
	1000

Smelt the copper and silver in the same proportions as if making silver coin nine-tenths fine, mixing them thoroughly.

Smelt the copper and gold in the same proportions as in making gold coin nine-tenths fine, mixing them thoroughly.

Having thus got the silver and copper together mixed and molten, and the gold and copper together mixed and molten, pour the latter into the former, and mix all up together thoroughly and cast into ingots, and roll out of the proper thickness into strips.

Clean off these strips the same as for silver coin, then immerse them, and let them lie in a bath of vinegar, sour-cider vinegar, over night. Wash them off in a solution of ammonia and rub them off well with a piece of buckskin and some whiting until polished. Then cut them and strike them up into coin with the gold metal itself forming the face of the coin.

To put a golden-tinge face on the coin on the same principle as that on which it wears: Pass the strips of metal through a bath of muriatic acid for about ten minutes, then place them in a strong solution of ammonia ; then wash them off with water and a brush ; then rub them off with a little whiting and buckskin to polish the faces of the strips. Then cut them, and strike up into coin.

The metallic face of the coin must come from the body of goloid ; not, in any case, from any externally applied metallic dressing.

WM. WHEELER HUBBELL.

Hon. H. R. LINDERMÀN,
Director of the Mint.

WASHINGTON, D. C., January 22, 1878.

SIR : Referring to my letter of January 21st of formula for goloid, when I say "clean off" these strips the same as for silver coin," I do not mean to use a sulphuric acid bath ; I mean only to wash or clean off any oil or foreign matter on them, to prepare them for the vinegar or aeetic acid bath. In no case whatever allow sulphuric acid on them. It tends to bleach the metal, impregnate it with sulphur and change its wear, and resistance to muriatic acid, which is a test of goloid, and which it resists, except to clean or develop the golden tint.

The purple tint is strongest when the vinegar or acetic acid *alone* is used (or a solution of about one part muriatic acid to four parts water). After it has laid over night in the vinegar, and less purple and more golden tint is desired, then it is passed through muriatic acid before it is passed into the solution of ammonia, color of the metal on the surface, and its ehemical elements unimpaired.

If the strips are much oxidized or rough, a very little emery mixed with the whiting might reduce the roughness. But emery tends to cut

and waste the metal surface. The whiting paste alone is best to finish and polish for cutting for the coin-press.

This more specific direction might be sent to Mr. Eckfeldt.

Respectfully,

WM. WHEELER HUBBELL.

Hon. H. R. LINDERMAN,
Director of the Mint.

WASHINGTON, January 28, 1878.

STATEMENT OF E. B. ELLIOTT.

MR. ELLIOTT. In response to an inquiry of one of the gentlemen of the committee, I will read the whole bill. It is as follows:

A BILL to promote the establishment of the metric system of coinage in the gold coins of the United States of America.

Whereas the metric system of coinage, based on the gram as the unit of weight, is now almost universally acknowledged to be the best; and

Whereas the gold coinage of the United States can be brought into exact conformity with the metric system by a change amounting to less than one-third of one per centum: Therefore,

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the gold hereafter coined by the United States shall contain, for each dollar of denominational value one and one-half grams of pure gold, and shall weigh, for each dollar, one and two-thirds grams, the proportion of the alloy to the entire weight being thus kept as one to ten.

SEC. 2. That such coins shall be legal tenders in payments arising from contracts made at any time after the fourth day of July, eighteen hundred and seventy-eight.

SEC. 3. That such coins shall have stamped upon them, in addition to other devices, their weight in grams, and the inscription, nine-tenths fine.

It will be seen that the weight of the pure metal is one and one-half grams. The change proposed from the existing standard is the least possible consistent with attaining the simplest relationship with the gram.

It is within the limit of tolerance or allowances with regard to the smaller gold coins; it is just without the limit of tolerance or allowance with regard to the larger coins; but it is within the limit of "least current weight," or of the wear and tear produced by current use, with respect to what legal allowance is made.

It would not involve any necessity for recoinage. Most of them are worn—certainly of the smaller coins—are worn within this range.

I exhibited the gold three-dollar piece last Friday when here. While the weight should have been five grams, decimal .0154 (5.0154 grams), its real weight, as ascertained at the mint (this particular piece), and as ascertained at the office of the Surgeon-General, in the one case (the former) 5.0007 grams, in the other 5.0016 grams. The difference or excess over 5 grams is quite inappreciable. It is unquestioned that the wear and tear of the average coins bring them already within the range of the proposed standard. Now if it be desirable to express in grams the weight of our dollar, both as to the pure metal and as to the standard metal, the bill proposes the simplest plan yet suggested. One-third of one per centum is a much smaller departure from the existing standard than any other that has been proposed. All the other changes proposed have been from eight to ten times as great as this, amounting to from two and one-half per centum to three and one-half per centum.

Reduction to the gold standard of France, or to the British standard—these all involved important changes. This does not. The change proposed is scarcely noticeable. Computations based on this are simpler than those based on any other. This I will illustrate. You have a mass of metal, a mass of gold of nine-tenths fineness; you know its weight in grams, and wish to know its value in metric dollars. Changed in this way from grams will show its value in dollars. Multiply the weight in grams by six, divide by ten, and it will give you the result in dollars. We can all recollect it; we can all comprehend that without difficulty.

The CHAIRMAN. How much is eight grams?

Mr. ELLIOTT. Six times eight is forty-eight; divide by ten, that makes four dollars and eighty cents.

The CHAIRMAN. Say fifteen grams?

Mr. ELLIOTT. Six times fifteen is ninety; divide by ten, that produces nine dollars.

The CHAIRMAN. You propose to coin a three-dollar piece?

Mr. ELLIOTT. The proposition would be to coin a piece weighing five grams and call it by some name, or a ten-gram piece, in order to meet the proposition of the International Statistical Congress. The unit of weight, that selected at The Hague in 1869, was that recommended by the coinage committee, Dr. Farr, chairman, at the International Statistical Congress. As chairman of the committee on weights, measures, and coinage, he recommended in a report of great length—an elaborate report, a copy of which I have—he recommended that in addition to the statement of values in the units of values of the countries to which the writers belonged, they should be stated in decagrams (ten grams) of gold of nine-tenths fineness. He proposed to give this coin the name "Victoria," after the Victoria gold-field.

Dr. Farr suggested that this coin (the dekagram of gold of nine-tenths fineness) should be divided into ten parts, each to be called a "sol;" so that ten sols would make this piece.

I think they would find it very convenient to use the term "sol," because the "sol" would represent the value of one gram of gold of nine-tenths fineness. The "sol" would be worth sixty cents, the one-tenth value of the proposed gold decagram.

In a letter which Dr. Farr addressed to the chairman of this committee (the Coinage Committee of the United States House of Representatives) some time ago, at the time this proposal was under consideration, he suggested that we coin a six-dollar piece, containing a dekagram of gold of nine-tenths fineness. Our present system requires the coinage of the three-dollar piece. It is within three-tenths of one per centum the half-unit proposed to the International Statistical Congress by their committee on coinage.

If this mode of reduction be made, if we coin that piece, the question is what better name could we give it, consistently with our standard unit, the dollar, than the three-dollar piece, as it would differ from it in value but a very small amount.

According to this bill, that piece of five grams nine-tenths fine would be called three dollars. I know of no better name for it. Its value in terms of the existing gold standard of the United States, \$2.99 $\frac{1}{10}$.

I gave an illustration a moment ago in relation to a mass of metal of standard metal, but gold is not always of the standard fineness. Sometimes the fineness is other than nine-tenths. In such cases you know its rate of fineness; you multiply by it, and reduce it to grams of pure metal. Then, having the weight in grams of pure metal, you will multiply not by six-tenths, for it is of more value than standard metal,

but by two-thirds, which in decimals will be .666+. Two-thirds of the weight in grams is the value expressed in dollars. Suppose, for instance, the metal to be nine grams in weight standard silver, the value, expressed in dollars, would be six-tenths of such weight, or five dollars and forty-five cents. Suppose it to be nine grams of *pure* metal in weight, its value, expressed in dollars, would be six dollars (that is, two-thirds of nine dollars). Supposing it to be eighteen grams of standard metal (nine-tenths fine) in weight, its value, expressed in dollars, would be ten dollars and eighty cents; but if eighteen grams of pure metal, its value would be twelve dollars. The operations are very simple compared with those with which we have to deal at present. If with our present standard we wished to reduce this mass of metal of nine-tenths fineness to its value as expressed in dollars, we must multiply it, not by six-tenths, but by 0.598+. I do not now recall the rest of the decimal expression. I can give it more exactly to the committee, 0.598+ and something more [later, 0.598153+]. You will find this formula many times of practical use in the conversion of the money-values of other countries into the money of our own country, and vice versa. It is difficult for me, an expert, to recollect it; that is, the formula necessary under our own present standard. But if you make this change, it would make this computation as easy for any one as for an expert. It is, six-tenths of the number of grams is the number in dollars.

Take the reverse proposition. Suppose you have a number of dollars: you wish to know their weight in grams; instead of multiplying you will divide by six-tenths; that is, divide by six and multiply by ten. When you know the number of dollars, in order to determine the weight of the whole, you divide by six and multiply by ten.

Suppose the question is, not what the weight of standard, but what the weight of pure metal is. Reverse the operation; that is, the operation by which we ascertain the value; we divide by two-thirds. Two-thirds of the quantity or weight will give you the value—not three-halves of it. If you know the value and wish to determine the weight of the whole, you divide by two-thirds (or multiply by three-halves instead of multiplying by two-thirds). You add fifty per centum to the value expressed in dollars and you have the weight of pure metal expressed in grams. The natural range required in these four operations is this: When you wish to ascertain the weight of standard metal of nine-tenths fineness, having the value as expressed in dollars, you divide by six-tenths, or multiply by ten and divide by six; or, to reverse it, if you have the weight in standard silver, to arrive at the value you multiply by six-tenths. If you have the weight in pure metal, in order to ascertain its value in dollars, you divide by two-thirds or multiply by three-halves, or the reverse proposition; having the value in pure metal, to arrive at the weight of the whole, you multiply by two-thirds. These make the four known operations in these cases. The operation is very simple. Now, any proposition that will involve more complicated arithmetical computation must be undesirable. I know of no process that is so simple as this; there is none more simple.

The CHAIRMAN. I desire to ask you if you mean to say that this denomination of one and a half grams of gold, and one and two-thirds grams in weight, is the best for our coinage.

Mr. ELLIOTT. I think it is.

The CHAIRMAN. Is that what Dr. Farr recommended?

Mr. ELLIOTT. He recommended the decagram of gold nine-tenths fine, the exact equivalent of six dollars of the proposed standard. If we

adhere to a value which is approximately near in comparison with the present standard of the United States, that is for us the best. Nobody wishes to change to any extent the standard of valuation; the only desire is to bring about a simple relation with the ruble, the franc, the mark, and other monetary standards. This is the best proposition that has yet been made, to wit, to bring the unit of our coins in relationship with that of the international unit of weight, the gram, so as to have simple relations with those countries adopting the gram as the unit of reference.

The object is to bring them in simple relation with us through the metric unit of weight. That is what we have to solve. When that is solved we have simple relations in our financial intercourse with each other. They may have for their monetary units one-fifth, one-half, or one-fourth of our unit of value. Simplicity must follow. It should be our object in making this change to conform as closely as possible with the gram in determining the value of your unit of value. If they (other nations) make theirs with less close relationship to the gram, it will be to their disadvantage.

This coin that Dr. Farr recommended, the gold decagram, I consider to be within the range of our proposed system. It is not a proposition to redeem that coin, the only international one. That is not the object. The intention is to have such a valuation in our standard unit of value that the relationship with the units of value in other countries shall be simple, so that the value of our coins may be easily compared with the value of coins of other countries.

Mr. MAISH. Have you prepared formulas for converting this proposed coin into the coins of the nations of the world as they now exist?

Mr. ELLIOTT. Yes; formulas for several of the leading nations of the world. I will append a table. I wish now to mention some fundamental units. The "sol" I have mentioned as one that Dr. Farr has given a name to; it is a gram of gold. What should we call the gram of gold pure? A name that we could use in referring to it when making comparisons? I have, I think, a name desirable, but I do not deem it essential that Congress should act upon it, but I have given it the name "ora" from "gold." I have found it quite convenient. You have the value of the "sol" as one to ten of standard gold; to convert "sols" into oras, and *vice versa*, it is simply necessary to use the formula which I have before given.

Mr. DWIGHT. Do you propose to introduce that coin under your system?

Mr. ELLIOTT. No, sir; I wish to make only a slight change in the value of the dollar.

Mr. MAISH. Take the three-dollar piece you propose; how would you convert that into the coins of other countries?

Mr. ELLIOTT. Its value is readily converted, as its weight is five grams, into all such coins as are either twenty, ten, or five grams in weight. I would also have coined a limited amount of the six-dollar piece, which would be the equivalent of the dekagram, in order to encourage the movement looking to the introduction of an international system of coinage.

Mr. DWIGHT. Do you consider that coin metrical and consistent with our own system of coinage?

Mr. ELLIOTT. Yes; I think it is. It will weigh of pure gold nine grains. It will contain nine grams of pure gold and one gram of copper. It would be nine-tenths standard gold.

Mr. DWIGHT. But, would not that six-dollar piece be so near the size of the five-dollar piece as to be dangerous?

Mr. ELLIOTT. I should only wish to have them coined in inconsiderable amounts. I think it is an open question whether we had not better confine ourselves to the three dollar piece, which is the half-unit of value. I will say that I am earnestly in favor of the coinage of the proposed three-dollar piece. They should weigh just five grams. Our present three-dollar pieces weigh a little over five grams. This I do not think is an open question. I think there is room for different opinion with regard to your question as to the six-dollar piece; but I do not consider it is so as to the three-dollar piece. We can announce to the world that we have coined the half-unit.

Mr. MAISH. Do you expect the international system of coinage will be adopted?

Mr. ELLIOTT. Yes; I think that all countries will eventually express their units of value with specific reference to the metric unit of weight. There are two nations which have already done what we are proposing; Japan has precisely the same, and the Argentine Republic has adopted it. So far as the adoption of an international system is concerned, our action would aid it. My belief is that those nations which coin a gold dollar will invariably adopt this metric dollar in consequence of its simplicity.

Mr. MULDROW. You propose a unit known as the "ora." What practical advantage would there be in having that as a unit of value, if the one gram is taken as the same representative of value?

Mr. ELLIOTT. I do not wish to propose any legislation in regard to names. I merely suggested that name. I do not wish it understood that I wish to have any particular name adopted. I am proposing to reduce the weight of our coinage so that the three-dollar piece shall weigh exactly five grams and our other gold coins in proportion. I have suggested the reduction of our dollar three-tenths of one per cent. for the future coinage. In comparing it for purposes of legislation with the coin of other countries I have used the name "ora" to denote a gram of pure gold, but even that is unnecessary.

Mr. RYAN. That is substantially your whole scheme, to reduce it three-tenths of one per cent.

Mr. ELLIOTT. That is all.

Mr. RYAN. And that you claim brings us into simpler relations with other countries?

Mr. ELLIOTT. Yes. My more complete reply to that question will be embraced in the reply I shall make in a few moments to the question previously asked by Mr. Maish.

Mr. CLARK. The three-dollar piece weighing five grams, and the six-dollar piece ten grams, are they in direct proportion under this system?

Mr. ELLIOTT. Yes, sir.

Mr. MULDROW. Please state in what way the passage of this bill would affect the relationship of our coins to those of other nations?

Mr. ELLIOTT. That will be fully answered in my reply to Mr. Maish's question. Allow me to state one fact. I noticed about this "goloid" a statement—I do not propose to go into this "goloid" question, except to call the attention of the committee to an error contained in the specification for a patent—a certain clause wherein it is set forth that the metal is nine-tenths fine. I wish to say that it is not nine-tenths fine, but that it is ten-elevenths fine. I want to say that the specification should be not nine-tenths but ten-elevenths fine. I want to say that the weight of sil-

ver as to the weight of gold is as twenty-four parts to one part, making twenty-five. One-tenth, which is the alloy, is two and five-tenths, that makes the whole twenty-seven and five-tenths, of which the amount of copper is one-eleventh, and that leaves the other parts ten-elevenths. I do not know that it is of any special moment, however.

Mr. MAISH. Is not this true, that taking the alloy as a metal there is but one-tenth alloy?

Mr. ELLIOTT. That coin has a certain weight; one-eleventh of that weight is copper, not one-tenth.

Dr. HUBBELL. That specification gives the certain proportion; then it says you may vary the proportions within the limits which makes its fineness. Now, then, that is the whole matter of the specification.

Mr. ELLIOTT. My remark is only with regard to the specification, by which he claims that that coin is made nine-tenths fine. I know nothing about the proportions used in coining this "goloid" dollar. I was reading the specification that was placed in my hands. He admits that I am right. Let us pass on.

Dr. HUBBELL. No, sir.

Mr. MAISH. As this statement of Mr. Elliott's was volunteered, it is not necessary to go further into this matter, I think. I should like to have your answer to the question I asked you before.

(This question was: Have you prepared formulas for converting this proposed coin into the coins of the nations of the world, as they now exist?)

Mr. MULDROW. What is the advantage claimed from the change proposed in this bill on the question of the relationship of our coins to those of other countries?

Mr. ELLIOTT. I will state the exact relationship between this and those coins of the world which have been more recently established which possess a definite relationship to the gram.

Mr. MAISH. Do not confine it, if you please, to that. Take the English coins. I want, particularly, to know about them.

Mr. ELLIOTT. I will first give three or four others, and then refer to the English coins. It is proposed, under this bill, to divide a kilogram into exactly six hundred parts. Under our existing system we divide it into five hundred and ninety-eight (and an incommensurable fraction) parts. This proposes to make it exactly six hundred.

Mr. MULDROW. One dollar will represent the six-hundredth part of a kilogram?

Mr. ELLIOTT. This proposes to divide the kilogram into six hundred parts instead of five hundred and ninety-eight, plus.

Mr. MAISH. For all coin?

Mr. ELLIOTT. Yes; for all the gold coins of the United States. I am speaking of this proposed standard. Six hundred dollars will weigh one kilogram. Japan and the Argentine Republic have already adopted this division; the Japanese "yen" and the "peso fuerte" of the Argentine Republic being each the six-hundredth part in weight of a kilogram. They were selected by both of these nations so as to conform as nearly as possible to our coinage, and at the same time give them the metrical weight. It was adopted in both cases in conformity to the United States system; and they made it as near as possible to the United States system as they could and preserve metrical simplicity. I will pass from that.

This same kilogram may be coined into thirty-one hundred francs. (In regard to the thirty-one hundred standard francs, their weight is precisely a kilogram.) I will call the attention of the committee to the fact

that while we are raising a question whether dividing by six is not awkward, France divides by thirty-one, a much more difficult subdivision. It is not a simple repetend, and I will state that none of the nations that have adopted relations to the gram have adopted any so simple as dividing by six.

In regard to the German "mark," there are, in the kilogram, not thirty-one hundred as in France, but twenty-five hundred and eleven.

I will also give you the Scandinavian crowns. They have been, within two or three years, adopted by the Scandinavian nations (Sweden, Norway, and Denmark). The coin which they have adopted—the gold crown which they have adopted within a very short time—represents one part of the two thousand two hundred and thirty-two parts into which they divide the kilogram.

The Netherlands: The ten-guilder piece contains of pure gold 6.048 grams; and from the kilogram of gold of nine-tenths fineness may be coined fourteen hundred and eighty-eight guilders (nearly). That completes the list of nations that have recently had legislation as to their coinage, so as to bring about a definite relation to the gram. By France I of course refer to the Latin Union and those that adopt their coinage.

The CHAIRMAN. Do you mean to say that the gram is a multiple of the values of all these coins?

Mr. ELLIOTT. Yes; the gram is a multiple of all the coins just mentioned, except those of the Netherlands. In the case of the Netherlands the coins are multiples of the gram. I mean to speak of nations where the gram system is referred to in their standard gold coinage, instead of grains troy.

The CHAIRMAN. You do not think, then, that they have a multiple?

Mr. ELLIOTT. The grams and the coins have simple mutual relations, and in all the gram is either a multiple of the coin, or the coin a multiple of the gram. In France, the kilogram of gold of standard fineness is divided into thirty-one hundred parts or francs; and, notwithstanding this, the method of computation in France is easier than in some other countries, of those adopting the metric relation.

The CHAIRMAN. How about the other nations?

Mr. ELLIOTT. Japan and the Argentine Republic would divide by six. The result would be the Japanese "yen," and the "pesos."

The CHAIRMAN. In this case the gram will be a multiple?

Mr. ELLIOTT. Yes; and, so far as pure gold is concerned, the coin is a multiple of the gram. The relationship grows out of the fact that you cannot make your coins out of pure gold; alloy must be added to give the requisite hardness to the coins, and a fineness must be adopted to correspond. With respect to England, while its standard is expressed in grains troy, there is also in a late revision of their law published a list of grams. That is, the value is expressed approximately in grams in the law.

The CHAIRMAN. How many grams in a British sovereign?

Mr. ELLIOTT. From forty troy pounds of gold of $\frac{11}{12}$ fineness (which is the standard of fineness of the gold coins of England) there may be coined 1,869 sovereigns. From a kilogram of pure gold may be coined 136.568 sovereigns, English, equivalent to 122.911 sovereigns from a kilogram of gold nine-tenths fine. The actual fineness of the metal is eleven-twelfths. The sovereign consequently contains of pure gold 7.3223854 grams, or of standard gold (eleven-twelfths fine) 7.9880568 grams, equivalent in gold of nine-tenths fineness to 8.1359838 grams.

Mr. MAISH. Would it not be with considerable difficulty that we

could express in our own coin the value of an article given in British coin?

Mr. ELLIOTT. This proposed coin will be no more incommensurable with the British coins than our existing system of coinage. Our existing system will make a British sovereign worth \$4.8665. This proposed coin will make it a little greater.

Mr. CLARK. I understand that the proposed coin would bring us no nearer in our own relationship to the British coinage.

Mr. ELLIOTT. Yes, sir; it would. Instead of \$4.8665, the value of the sovereign would be \$4.8816, which is nearly four and eight-ninths, or 4.89; it would be four and eight-ninths if all of the decimals were eights. There would be an interminable decimal; there is now, and there would be an interminable decimal in either event. The law that defines at what it may pass does not give the decimal beyond \$4.8665. If you wish to continue it, it will be 6.

It is interminable now, and will be then. It is the simplest, however, because the British system is based on the troy system, which is incommensurate with the metric system.

I would repeat one statement that I made in the course of my remarks on Friday. The object to be attained by this slight change is to simplify computation so that the school-boy, the merchant, the teacher, or the business man may be able readily to arrive at the value of the article if the gram system shall prevail. Also, since the gram system is very largely obtaining for international purposes, and is destined in the early future to be universal, in my opinion, I think this change will enable them to make computations into other coins almost immediately, because the tables have been prepared, giving the coins of the world in grams. Expressed in the form of grams, it will greatly facilitate computation.

Mr. MAISH. Formulas can be furnished for converting the British coin into this one?

Mr. ELLIOTT. Yes, sir; if the amount is given in grams, it is reduced immediately. Where the number is given of nine-tenths fineness, you multiply by six and divide by ten, and get the value in pure metal.

Mr. ELLIOTT presented the following table:

Table comparing the standard gold coins of certain countries with those of the United States, and also with those of the proposed metrical system of coinage.

Names of pieces.	Pieces of in a kilogram of gold.			Standard weight.	Weight fine.	Value in dollars.
	$\frac{1}{10}$ fine.	Pure.	Fineness.			
<i>Existing United States standard:</i>						
One dollar (\$1)	598.15306	664.61451	Grams. 900	1. 5046316	\$1.00308	
Three dollars (\$3)	199.38435 +	221.53817	900	4. 5138948	3.00924	
Half eagle (\$5)	119.630612	132.922902	900	5.0154387	5.0154	
Eagle (\$10)	59.815306	66.461451	900	8.359065 —	10.0308	
Double eagle (\$20)	-29.907653	33.230726	900	16.718129	20.0616	
Proposed metric:				33.436258	30.092632	
One dollar (\$1)	600	666.66	900	1. 66	1.5	0.99692
Three dollars (\$3)	200	222.22	900	5.00	4.5	2.99076
Half eagle (\$5)	120	133.33	900	8.33	7.5	4.9846
Eagle (\$10)	60	66.66	900	16.66	15	9.9892
Double eagle (\$20)	30	33.33	900	33.33	30	19.9384
<i>Latin Union:</i>						
Ten francs	310	344.44	900	3.22581	2.90323	1.929526
Twenty francs	155	172.22	900	6.45161	5.80645	3.859050
<i>German Empire:</i>						
Ten marks	251.1	279	900	3.98248	3.58423	2.38948
Scandinavian (Sweden, Norway, and Denmark):						
Ten érownis	223.2	248	900	4.48029	4.03226	2.679894
Netherlands:						
Ten guilders	148.809	165.344	900	6.72	6.048	4.0196
England:						
Sovereign (240 pence)	122.911	136.568	916.67	7.9880568*	7.3223854	4.88159C3
				8.1359838†		4.8665635

* Standard.

† $\frac{1}{10}$ fineness.

NOTE.—The dots beneath certain figures in this table are designed to denote that the fraction is a repetend or continued decimal. For instance, 222. $\overline{32}$ denotes 222.323232, and so on indefinitely, equivalent to 222. $\overline{3}$.

MONETARY EQUIVALENTS.

1 international statistical unit	= dekasol = 6 metric dollars (yens).
1 dollar	= $\frac{1}{6}$ or 0.166 dekasol.
1 franc	= 0.1935484 dollar (yen).
1 dollar	= $5\frac{1}{6}$ or 5.1666 francs.
1 mark (German)	= 0.2389486 dollar (yen).
1 dollar	= 4.185 marks.
1 crown (Scandinavian)	= 0.2688172 dollar (yen).
1 dollar	= 3.72 crowns (Scandinavian).
1 guilder (Dutch)	= 0.4032 dollar (yen).
1 dollar	= 2.480159 guilders.
1 pound sterling (£1)	= 4.8815903 dollars (yens.)
1 dollar	= .20485 pound sterling,

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
International statistical unit—dekarogram of gold of $\frac{9}{10}$ fineness—dekasol.....	100	111.11...	900	10	9	6	5.98153

The following letters were also ordered to be placed on the minutes :

HOUSE OF REPRESENTATIVES,
Washington, D. C., December 29, 1877.

DEAR SIR: Can you conveniently furnish this committee of the House of Representatives with specimens of coinage of the goloid dollars, halves, and quarters, on the basis of Dr. W. W. Hubbell's compound of gold, silver, and copper, which he has patented as a new metal, styled goloid, which consists of the following proportions of each of the above-stated metals, to wit, one pound of standard gold nine-tenths fine and twenty-four pounds of standard silver nine-tenths fine; this has in it due proportion of copper as in the present coin with its alloy of copper, &c.

We want each dollar to contain 258 grains of the goloid metal, and in same proportion for half and quarter dollars; that is, the half-dollar to have in it 129 grains goloid, and the quarter 64½ grains, &c. Let the coin, if you please, have stamped on it these words: On the dollar, "Goloid, one dollar, 1 G., 24 S., .9 fine, 258 grains;" on half-dollar, "Goloid, half-dollar, 1 G., 24 S., .9 fine, 129 grs.;" on quarter-dollar these words, "Goloid, quarter-dollar, 1 G., 24 S., .9 fine, 64½ grs."

The committee would like to have these specimens in sufficient numbers for the convenience of members of Congress by the 10th day of January next, or as soon as practicable.

Yours, truly,

ALEXANDER H. STEPHENS,
Chairman House Committee on Coinage, &c.

H. R. LINDERMAN, LL.D.,
Director United States Mint, Washington, D. C.

WASHINGTON, D. C., December 26, 1877.

DEAR SIR: Referring to the letter of Hon. Alexander H. Stephens, of this date, chairman of Committee on Coinage, &c., House of Repre-

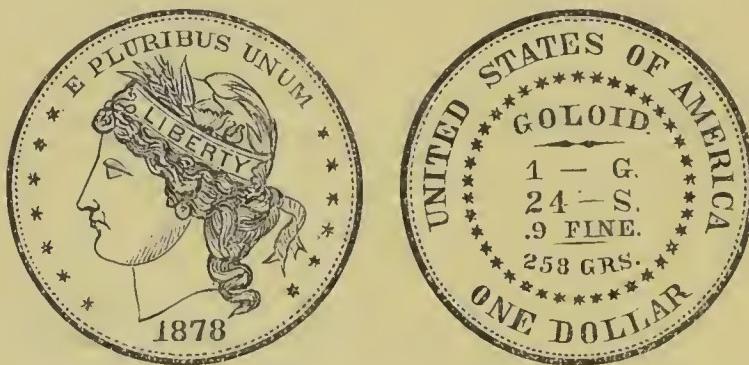
sentatives, respecting sufficient specimens of goloid coin of my patent for inspection of members of Congress, it is perhaps best that there should be at least one of each coin for each member to examine, as he may elect so to do.

Also, the proportions, expressed in thousands, are : gold, pure, .036 ; silver, pure, .864 ; copper, pure, .100. In the coin when finished being .900 fine : gold one to twenty-four in weight of silver ; copper, two .77 = gold rated as one equivalent to sixteen of silver. Relative value, 40 per cent. of gold to 60 per cent. of silver.

As to the design of the coin, allow me to suggest for your consideration the following devices and legends :

Upon one side an impression emblematic of liberty, with an inscription of the word "Liberty," using as the impression the head-design of Pater Patriæ, George Washington, who achieved the liberty, thus :

Goloid dollar, exact size.



Color, gold purple, when correctly minted.

"Liberty" large on the upper half and reversed "God and our country," smaller on the lower circuit half, and the words "God and our country," with the thirteen stars representing the original States or the Union, and date of coinage at the bottom, and numerical value in cents at the top ; and upon the reverse the inscriptions, "United States of America," "E pluribus unum," placed around the rim in reverse, and immediately inside of this place a circlet of stars equal to the present number of States of the Union, and inside of this circlet place the inscription of the name, denomination, and component parts of the coin as stated in said letter of the Hon. A. H. Stephens. The star circlet is peculiarly our national emblem, instead of a leaf circlet, which is Napoleonic French ; and the stars could be perfectly formed with a rose head-drill and then cut five-pointed. If the inner, top, and lower points are united, the circlet is perfectly national, and emblematical of the "United States." In the formation of the goloid a little sulphate of potash tends to prevent oxidation. The metals are mixed by stirring in fusion a few minutes to allow a complete formation into the new metal.

In conferring with the Hon. Alexander H. Stephens, chairman of the Committee on Coinage, &c., he informed me that the design of the goloid-coin specimens had better be fixed by Dr. Linderman and myself, and, with these suggestions only, I respectfully leave it to Dr. Linderman, they being an effort to conform to his views expressed on this subject in his annual report of 1877.

Yours, truly,

WM. WHEELER HUBBELL.

H. R. LINDERMAN, LL. D.,
Director of the United States Mint.

HOUSE OF REPRESENTATIVES,
Washington, D. C., January 8, 1878.

In addition to the specimens of goloid coin of the patent of W. W. Hubbell heretofore requested, will Dr. Linderman be pleased, if it does not involve too much trouble or expense, to furnish from the same dies fifty specimen dollars of goloid of 258 grains each, on the basis of alloy as follows: gold, .040; silver, .860; copper, .100; equivalent to gold, 1; silver, 21.5; copper, 2.5, and marked to distinguish them from the others.

Also to inform the Committee on Coinage, Weights, and Measures what the market-value of the silver in goloid coin would be in London, at present rates, as compared with silver, according to the advices received at the Treasury (of quotation in sterling silver and silver with 5 per cent. of gold).

Also what is the Treasury or mint estimate of the gold value of the goloid dollar (in United States gold coin) on the basis of gold, .036; silver, .864; copper, .100; and also what the value of that on the basis of gold, .040; silver, .860; copper, .100, when silver is 54d., 55d., 56d., 57d., 58d., 59d., 60d. per ounce, respectively, in London.

Also to inform the committee what would be the market-value at present of the United States dollar of 412.5 grains of silver nine-tenths fine, and what its value at the respective values of silver before stated; and what the difference in value between the silver dollar of 412.5 grains and the goloid dollars stated and the United States gold dollar of 25.8 grains, at the stated valuation of silver (sterling) in London.

ALEXANDER H. STEPHENS,

Chairman of House Committee on Coinage, Weights, and Measures.

H. R. LINDERMAN, LL.D.,
Director of the Mint.

TREASURY DEPARTMENT,
OFFICE OF THE DIRECTOR OF THE MINT,
Washington, D. C., January 14, 1878.

SIR: I have to acknowledge the receipt of your communication of this day in which, in accordance with the resolution of the Committee on Coinage, Weights, and Measures, you request me to appear before the committee on Thursday, the 17th inst., at 10½ o'clock a. m., to give information on the subject of the coinage, and in reply to say that it will afford me pleasure to attend as requested.

Very respectfully,

H. R. LINDERMAN, *Director.*

Hon. A. H. STEPHENS, M. C.,
*Chairman Committee on Coinage, Weights, and Measures,
House of Representatives.*

TREASURY DEPARTMENT,
OFFICE OF THE DIRECTOR OF THE MINT,
Washington, D. C., January 14, 1878.

SIR: I have your letter of the 8th instant, requesting that there be struck from the dies prepared for the proposed goloid dollar fifty specimen dollars of 258 grains each, on the basis of an alloy of 40 parts gold and 860 parts silver.

As the dies have been prepared with an inscription based on an alloy of 36 parts gold and 864 parts silver, it would not be proper to strike pieces of a fineness different from that expressed by the dies.

The slight variation in fineness as proposed would not make any perceptible difference in coin struck from either alloy; but if you desire that pieces should be struck on the basis of 40 gold and 860 silver, I will cause dies to be prepared in conformity therewith, as early as may be practicable.

I have caused to be prepared the following computations, requested by your letter, relative to the gold equivalent of silver in goloid coins on the basis of gold 36, silver 864, and gold 40, silver 860; the equivalent of the silver dollar of $412\frac{1}{2}$ grains, at the various quotations furnished, 54, 55, 56, 57, 58, 59, and 60 pence, and also the difference in value between the silver dollar of $412\frac{1}{2}$ grains and the goloid dollars stated and the United States gold dollar at the quotations given.

1st. The gold equivalent of the goloid dollar, on the basis of 36 gold, 864 silver :

Silver at—	Gold.	Silver.	Total.
54 pence.....	40 cents.	54. 97 cents.	94. 97 cents.
55 pence.....	40 cents.	55. 99 cents.	95. 99 cents.
56 pence.....	40 cents.	57 cents.	97 cents.
57 pence.....	40 cents.	58. 02 cents.	98. 02 cents.
58 pence.....	40 cents.	59. 04 cents.	99. 04 cents.
59 pence.....	40 cents.	60. 06 cents.	100. 06 cents.
60 pence.....	40 cents.	61. 07 cents.	101. 07 cents.

2d. On the basis of gold 40, silver 860 :

Silver at—	Gold.	Silver.	Total.
54 pence.....	44. 44 + cents.	54. 72 cents.	99. 16 + cents.
55 pence.....	44. 44 + cents.	55. 73 cents.	100. 17 + cents.
56 pence.....	44. 44 + cents.	56. 74 cents.	101. 18 + cents.
57 pence.....	44. 44 + cents.	57. 76 cents.	102. 20 + cents.
58 pence.....	44. 44 + cents.	58. 77 cents.	103. 21 + cents.
59 pence.....	44. 44 + cents.	59. 78 cents.	104. 22 + cents.
60 pence.....	44. 44 + cents.	60. 8 cents.	105. 24 + cents.

3d. The equivalent of the silver dollar of $412\frac{1}{2}$ grains :

54 pence	91. 56 cents.
55 pence	93. 25 cents.
56 pence	94. 94 cents.
57 pence	96. 64 cents.
58 pence	98. 33 cents.
59 pence	100. 03 cents.
60 pence	101. 72 cents.

4th. The difference in value between the silver dollar of $412\frac{1}{2}$ grains and the goloid dollar, on the basis of gold 36, silver 864 :

Silver at—	Difference.
54 pence.....	3. 41 cents in favor of goloid.
55 pence.....	2. 74 cents in favor of goloid.
56 pence.....	2. 06 cents in favor of goloid.
57 pence.....	1. 38 cents in favor of goloid.
58 pence.....	. 71 cent in favor of goloid.
59 pence.....	. 03 cent in favor of goloid.
60 pence.....	. 65 cent in favor of silver dollar.

5th. On the basis of gold 40, silver 860 :

Silver at—	Difference.
54 pence.....	7. 60 cents in favor of goloid.
55 pence.....	6. 92 cents in favor of goloid.
56 pence.....	6. 24 cents in favor of goloid.
57 pence.....	5. 56 cents in favor of goloid.
58 pence.....	4. 88 cents in favor of goloid.
59 pence.....	4. 19 cents in favor of goloid.
60 pence.....	3. 52 cents in favor of goloid.

6th. Difference between the goloid dollar and the United States gold dollar; goloid on the basis of gold 36, silver 864:

Silver at—	Difference.
54 pence.....	.5.03 cents in favor of gold dollar.
55 pence.....	.4.01 cents in favor of gold dollar.
56 pence.....	.3 cents in favor of gold dollar.
57 pence.....	.1.98 cents in favor of gold dollar.
58 pence.....	.96 cent in favor of gold dollar.
59 pence.....	.06 cent in favor of goloid dollar.
60 pence.....	.1.07 cents in favor of goloid dollar.

7th. On the basis of gold 40, silver 860:

Silver at—	Difference.
54 pence.....	.84 cent in favor of gold dollar.
55 pence.....	.17 cent in favor of goloid dollar.
56 pence.....	1.18 cents in favor of goloid dollar.
57 pence.....	2.20 cents in favor of goloid dollar.
58 pence.....	3.21 cents in favor of goloid dollar.
59 pence.....	4.22 cents in favor of goloid dollar.
60 pence.....	5.24 cents in favor of goloid dollar.

Very respectfully,

H. R. LINDERMAN,
Director.

Hon. ALEXANDER H. STEPHENS,
Chairman House Committee on Coinage.

TREASURY DEPARTMENT,
OFFICE OF THE DIRECTOR OF THE MINT,
Washington, D. C., January 15, 1878.

SIR: I have received from the mint at Philadelphia ten dollar pieces struck in an alloy styled "goloid," in compliance with your request of the 27th ultimo, which are held subject to your orders.

The mint will be reimbursed for the bullion contained, four dollars in gold and six $\frac{42}{100}$ dollars in fractional silver, which amounts you will please transmit to this office.

Very respectfully,

H. R. LINDERMAN,
Director.

Hon. ALEXANDER H. STEPHENS,
Chairman House Committee on Coinage.

A UNIVERSAL SYSTEM OF WEIGHTS, MEASURES, AND CURRENCY.

WASHINGTON, GA., January 18, 1878.

MY DEAR SIR: I herewith send my metrical ideas, reduced to practical form, in a series of tables ready for use. I send also an argument in favor of the proposed modified form of the metric system. The modifications are the condensed essence of much thought, intended to aid a great practical reform to go down. The desire for the introduction of the system is much more general than the proper appreciation of its difficulties, which, unfortunately, are much greater in fact than in appearance. If you set it afloat successfully in Congress, a great work indeed

will have been accomplished, vastly transcending in real importance its seeming insignificance.

There really lies the trouble. The real means have been despised, viz, *adaptation*, and the whole system is therefore still a dead letter; a pretty scientific toy, instead of a great labor-saving machine to the millions of mankind. But I need say no more of this to you, for you already appreciate it. Twelve years have not introduced a solitary table of the metric system into a solitary class or profession of the American people.

You will remember a note on this subject some years ago, addressed to you, when out of public life, as to a philosophical statesman interested in everything promotive of human progress. I now address you officially as chairman of the Committee on Weights, Measures, and Coinage, and as one ever deeply interested in matters not temporary, local, or partisan, but of permanent benefit to the whole country and all its classes and interests.

Yours, very respectfully,

SAM'L BARNETT.

Hon. ALEXANDER H. STEPHENS,
Chairman, &c.

ADVANTAGES OF A UNIVERSAL SYSTEM OF WEIGHTS, MEASURES, AND CURRENCY—THE WAY TO INTRODUCE IT.

In favor of well-considered Congressional action for the better introduction of the metric system may be urged:

1. The clear constitutional *right* of Congress to fix the standard of weights and measures, the corresponding duty, and the great importance of its exercise, now generally admitted.

It is no doubtful power, but one with which Congress is especially charged, and of which it is the only, as it is the best and proper, depositary. Its exercise is no trespass upon the rights of any—of State or people—but of common benefit to them all.

2. There has already been some useful action, which needs to be perfected.

Under the wise suggestion of Thomas Jefferson the decimal system of currency was adopted in , which has been of inestimable service to the whole country and to all classes of society, saving to all merchants, bookkeepers, bankers, and accountants, and to citizens generally, including school children, immense labor in calculation in the daily transactions of life and in the details of business. In every process—addition, subtraction, multiplication, division, and yet more in percentage, interest, insurance, commissions, and the like—through all the details of common life, its immense advantages are felt.

This shows what can be done by a good system. We are ever forgetful of the advantages to which we have become accustomed; but in the present case they are endless.

At a later period, in the question of the introduction of the metric system as a whole, the unfavorable report of John Quincy Adams in 1821 was the occasion of a long delay. His report was very able and elaborate. His appreciation of the merits of the system was high; but of the difficulties equally, and perhaps excessively, high.

It was not until 1866 that Congress at last passed the act authorizing its use. In 187— the gold dollar was made to conform as nearly as practicable to metric weight. The general subject is now again before Congress and the public, by virtue of the resolution of November 6, 1877, requesting the views of the heads of departments as to its introduction

into their official transactions, by way of bringing the public more in contact with the system.

Aside from Congressional action, there has been much private effort. Under the auspices of the University of the State of New York, two elaborate reports on the subject of metric reform have been made: the first, by Prof. Charles Davies, unfavorable, and regarding the difficulties great and almost insuperable; the second, by President F. A. P. Barnard, of Columbia College, New York City, strongly favorable, and perhaps the most full and valuable review of the subject ever presented. Thus there has been large outside co-operation of a voluntary character, individual and by associations, scientific and business.

3. Next in order we must refer to the utterly unavailing character of all the action of Congress heretofore taken, and of all the informal and outside efforts, and the entire failure of the people to adopt the metric system, notwithstanding all those efforts. What have twelve years of trial exhibited? We see here a discouraging aspect of the case. The law is a dead letter, virtually void. As a fact, no single class of the community yet uses a single table of the metric system. All the proposed advantages in the other tables akin to those in the table of decimal currency have heretofore failed to be realized.

4. There is evident need of inquiry in order to remedy this evil. Has a common system become less important than formerly? On the contrary, the growing importance of a common system, internally and externally, is obvious. Intercourse of all sorts—business, scientific, practical—is constantly increasing.

Whatever reasons applied in 1787 for uniformity and for a good practical system among the thirteen States, apply now with incomparably greater force to the intercourse of thirty-eight States and an immensely enlarged commerce with foreign powers. Our internal and external trade have alike increased enormously. Intercourse with Europe now is quicker and more constant than then between the distant States. New York and Georgia were then more remote in time than New York and any part of Europe now, or many parts of Asia or Africa.

Congress for good reasons passed the act of 1866. The reasons grow stronger year by year—commercial, scientific, personal—with increase of exchange, of travel, of calculation, of the interchange of productions and the interchange of knowledge. If that act has virtually failed of its purpose, it must by new action be made effective and practical.

The duty devolves on Congress, therefore, to inquire diligently into the impediments and causes of delay. No other authority is adequate, and none other provided; and it is the duty of Congress to the whole country, as a matter of universal concern, affecting all interests and all classes, being no question of doubtful power or policy, to see to this great practical reform; watching against failure, careful to secure results, and adapting means to ends, till the real object is attained, viz., the actual every-day use of the system and the reaping of its advantages, just as those of the currency system already in use. America especially needs it, as the home of a peculiarly trading, commercial, and calculating people.

5. The friends of metric reform, being generally men of science and learning, have failed to appreciate its real difficulties.

To them these difficulties do not exist, and they underestimate their real influence on the common mind.

The result of inquiry shows a large reception of the metric system on the part of governments, but a small use of it on the part of the peoples. Even in France, its home, the use of the metric system is imper-

fectedly diffused. It is worse than useless to ignore this; it must be studied and met. There is evidently some want of adaptation in the system to common use.

This failure of adaptation is not in its substance, but in its form. It is too learned—too remote from popular apprehension.

Experience shows that the difficulty lies here: the names are harder than the things.

This is shown in France by the adoption of the new units under the old names which come nearest to them.

It is shown also by the efforts to *nick* the long metric names in the United States and elsewhere.

According to the ever-growing light upon the laws of language, the names must conform to familiar usage in order to suit the common people. Nay, even the learned would handle them better thus.

A newspaper paragraph, in a very common-sense way, presents the real difficulty of introducing the system:

To understand the metric system, you must know what is a millimeter, a centimeter, a deimeter, a meter, a dekameter, a hektometer, a kilometer, a myriometer, a centigram, a decigram, a gram, a dekagram, a kilogram, a myriagram, a centiliter, a deciliter, a liter, a dekaliter, a hektoliter.

There is the trouble; and even the foregoing list is not exhaustive; two entire tables are omitted. Too many new units, and too many new words, long and learned.

6. For remedy whereof there is needed not a mere interposition of authority, not a law making the use of the system peremptory and obligatory, but a far better and higher means, viz, *adaptation*.

No law can make the people understand the foregoing names.

It is indeed said by the learned that a child can master them in a day. It is certain, however, that a people have not mastered them, and will not, in a generation. The difference is world-wide between the adoption by a government or by the heads of departments of a government and the adoption by the people at large.

Not by declaring the difficulties small, but by making them so, is the evil to be remedied. It has been a disastrous mistake heretofore that they have been underrated.

7. The following principles are suggested, as the result of much thought, to aid in the solution:

Every reduction and simplification helps. There will be plenty of difficulty left in overcoming the inertia of the common mind when reduced to a minimum.

A large *reduction in the number of units* may be effected, not only without loss, but *with positive advantage* to the system.

While the scale should be decimal, there need not be a new denomination for *every ten*. The *cental* scale will often do better.

The mind may be taught to run in *really the best grooves*. For practical purposes, usually 100 is the best basis, as dollars and cents show.

If measures of length increase by tens, the squares on these increase by one-hundredths, and the cubes by one-thousandths.

A great practical question also constantly rises as to the use of *halves* and *quarters*, *doubles* and *fours*. Their use cannot be prevented. But no new names should be provided; let them be called half, quarter, &c., and the difficulty disappears.

But all the other troubles are minor as compared with the metric names. They are the real incubus. To deal with this difficulty, the names for English people should be English names, and so each people

should have names in its own tongue; *the names should suggest the thing*; they should answer the natural questions, *how long? how large? &c.*

Take the metric name, centimeter, for example. The instant question is, "How long is it?" If, showing a finger-nail, you should answer "about a nail's breadth," a good idea of its length would be had.

In the old system, the word "barleyeorn" made a direct appeal to experience—every one knew about how long it was; a cubit, a span, a foot, made like appeals. The yard was a switch; the rod or pole conveyed its own approximate length. The trouble with the old system was not in its names, but its *scale*.

Generically, it may be said that in adapting the metric system to common use, the great object to be aimed at is familiarity! familiarity! familiarity! Even when reduced to a minimum, there are so many new units and so many new names essential, that it is very difficult to secure familiarity, and without this the use of the system cannot be secured. The number, the length, and the foreign aspect of the metric names will suffice, for more than one generation, to prevent anything like popular familiarity.

S. Practical steps.

Let the appropriate committee, after full conference with those likely to aid in the matter, prepare and report a provisional system of tables intended to reduce the difficulties to their lowest terms. Let the number of denominations be reduced, if they think advisable. Let the names be simplified and made suggestive; let them be short, terse, suggestive, and *English*. Let it be made *lawful* to use these names in all business transactions.

The use of the metric names need not be prohibited; only the use of the English names should be permitted. The metric unit would be *the same* in either case.

In the preparation of the tables, the committee would confer not merely with men of scientific attainments, but with students of language and its laws, and with business-men, merchants, druggists, farmers, and teachers. A system, to fit all classes, must needs be simple. Congress, itself, composed of the Representatives of the people, is well informed as to the needs of the people, and what will suit them.

We have now the benefit of the experience of many other countries and our own. If we can solve this problem, we shall have conferred an inestimable benefit on our own people and on the world at large.

9. The following brief tables, intended only as suggestive, will illustrate the general principle intended to be embodied in the system. Of course, the exact names and the exact denominations to be retained are to be the subject of much consideration.

To go into a full explanation would require much space. Those who best know the difficulties will be the best judges of the approximate solution. Some of the points which the inconsiderate would criticise are really the most essential or valuable features, meeting the specific difficulties.

Beginning with length, we think 4 selected denominations will suffice, and serve really a better purpose than 8. One of these denominations, which we would designate a hair's-breadth, would serve for microscopic objects.

It is seldom necessary in any one statement to refer to more than two denominations of length, related like dollars and cents, or wholes and hundredths. When more is necessary, decimals serve the purpose best.

The hair's-breadth would be $\frac{1}{250}$ part of an inch.

The nail's-breadth, the next denomination, now called centimeter,

would be 100 hair's-breadth in length, equal to about $\frac{2}{5}$ inch; accurately, 0.3937 inch.

The next unit, the meter, might perhaps retain that name with an explanation added, thus: a meter, or long yard.

The kilometer could be expressed as a short mile. It is frequently contracted into kilo. An accidental association exists which might serve a purpose. Instead of "short mile," it might soon become familiar as "kile," simply by the similarity.

For astronomical purposes a fifth denomination might be employed, if thought desirable after a time, to be called an "earth quadrant," being 10,000 kiles.

The table then would read thus:

Length.

100 hair's-breadth make a nail's-breadth.

100 nail's-breadth make a meter, or long yard.

100 meters, or long yards, make a short mile, or kile.

10,000 kiles, or short miles, make an earth quadrant.

This would soon be contracted by English habit to—

100 hairs make a nail.

100 nails make a meter.

100 meters make a kile.

The second table—of capacity—would also admit of great reduction.

The lowest denomination proposed would be the drop, equal to $\frac{1}{160}$ cubic inch. It is less than a milliliter, and would serve valuable purposes of expression.

The second would be a spoonful (soon to become spoon), corresponding to the centiliter, and containing about $\frac{3}{10}$ of a cubic inch; accurately 0.6102 cubic inch, or 0.338 fluid ounce.

The third, the liter itself, might well be called a quart, being between the present dry quart and liquid quart.

The fourth, 100-quart, called the cask or keg, and being the unit in the measurement of things dry as well as liquid, as of corn, wheat, &c.

The table would be—

100 drops make a spoon.

100 spoons make a quart.

100 quarts make a cask.

In weight the first unit would correspond with the milligram, and we would call it a mustard-seed, or simply a seed, being about $\frac{1}{70}$ of a grain, or accurately 0.0154 grain.

The second might be called a grain, but for the preoccupation of that name we would suggest a *corn* = $1\frac{1}{2}$ grains.

The third a nut = $\frac{1}{3}$ ounce.

The fourth = $2\frac{1}{2}$ pounds = a double pound or bi-pound, which would ultimately become a bip.

Table of weight.

100 seed make a corn.

100 corns make a nut.

100 nuts make a bi-pound.

We might add—

1,000 bi-pounds make a ton.

In square measure the table is easy; perhaps 10,000 square meters make a great acre, the great acre being 2.471 acres.

In volume, or cubic measure, there is no need of a separate table from that of capacity. If any, however, it might be—

1000 dice = 1 quart block.
1090 blocks = 1 cubic meter.

In currency (for a system elsewhere than in the United States), simple as it now is, the table might be reduced to but two denominations and read thus:

Currency.

100 cents make a dollar.

These simplified tables are studiously adapted to common and actual use. They serve all purposes of expression and calculation. No object is too small or too large for easy and adequate expression.

In length, beginning lower than the metric system, with a length just visible to the naked eye, the table extends higher for astronomical objects. With fewer denominations it covers the whole range of scientific and practical use.

So in each table. In capacity, beginning with a drop, it provides for the smallest uses and extends high enough for the greatest; for the druggist, the wine merchant, the grocer, and the farmer, for all purposes of measurement of liquids or solids, of wine, oil, or grain.

In weight, beginning with one scarcely appreciable, it provides for all exigencies, from those of the apothecary and jeweler, through the whole range of common business, to the needs of railroads or steamships.

They reduce the difficulties to a minimum, not sacrificing any of the advantages, but rather enlarging these, as might be shown by elaboration. There are no unnecessary units to be learned, and no unnecessary words. The names are familiar and suggestive. The whole method appeals to common sense. It has been largely suggested by the careful study of the currency system.

Perhaps we could not more forcibly illustrate the relative simplicity of the proposed system and the old, than by showing what the currency-table would become if metricised according to the principles of nomenclature.

It would read thus:

Formal table of currency.

Ten milli dollars make a centi dollar.

Ten centi dollars make a deci dollar.

Ten deci dollars make a dollar.

Ten dollars make a deka dollar.

Ten deka dollars make a hecta dollar.

Ten hecta dollars make a kilo dollar.

Ten kilo dollars make a myria dollar.

What would be the relative facility of introducing such a table, and the simplified form, 100 cents make a dollar?

The problem with its difficulties is worthy of the highest statesman-

ship. It has actually engaged for nearly a century the interest and efforts of numerous statesmen—men of science and men of business. The partial solution of it, in the table of currency, has already been of inestimable advantage—even that simple table has been trimmed down from 5 denominates to 2—showing the tendency to simplify. Associations and individuals are voluntarily striving for like results in the whole system. Congress, as the constitutional authority for the purpose, should do its full duty, and use all wise and discreet means to expedite this important reform. At present it but drags its slow length along. It were worth much politics to adapt it to speedy use, and secure to the people at large a labor-saving machine—pronounced by John Quincy Adams to be *greater even than steam*—and one of the chief instrumentalities of civilization.

